AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

VOLUME 20. NEW YORK, THURSDAY, AUG. 5, 1897. NUMBER 31.

American and Other Machinery Abroad—XII.

[Editorial Correspondence]

RUSSIA.

Russia seems to an American to be a country of sharp contrasts and of contradictions. Many of the letters of its alphabet are reversed, and some of those which are like ours stand for entirely different sounds. Nearly every business man here has two entirely different and contradictory reputations, and unless you have time to make your own investigation, you must take your choice between them. You will get a different story from every man you ask about distances or the time of departure or arrival of trains, and when a droshky driver stops his horse, he does it by an explosive burr-r-r-r which, in any other country in the world, would instantly cause a runaway. I find considerable difficulty in forming definite conclusions regarding anything here in Russia. A conclusion arrived at one day is apt to be upset by the observations or experience of the next. The experience of different individuals differs widely, and the experience of the same individual may be compounded from a very wide variety of incidents, ranging in character from the most pleasant and satisfactory, to those most decidedly the opposite.

There is a class of people here who may be called inordinately prosperous, who spend money very freely and set a pace, so to speak, in St. Petersburg and here in Moscow which makes living of the better class very expensive; while below them is the class composed of almost countless millions of Moujiks and others, who perform manual labor of various kinds at extremely low wages, and live, in huts, on tea and black bread, the monotony of which is relieved, as opportunity offers, by large libations of the famous vodka, which seems to be little else than pure alcohol, and brings temporary oblivion to this world's sorrows at a cost within reach of the poorest purse.

The variations in experience begin at the frontier, as you enter Russia, and seem to be without special reason, except so far as reasons can be found in the individual idiosyncrasies of the man who inspects your luggage. My own experience at the frontier, for instance, was not an unpleasant one, and the examination was of a very cursory character; while, in sharp contrast to this was the experience of a prominent American engineer and his daughter, who, upon crossing the frontier, had to give up to an ignorant inspector having command of the Russian language only, some newspapers which had been sent them from home and some books of travel, all of the most innocent and inoffensive character, and were required, also, to deposit with the inspector a sufficient sum of money to defray the cost of transportation of the books and papers, in case it should be concluded, after due examination and consideration of them, that it would be safe for them to enter the country. At last accounts the books and papers had not been received, and the loss of them was being felt rather severely, and of course was going far to create and deepen an unpleasant impression of the country and everything connected with it; an impression, in fact, which the people of Russia do not deserve, for they are a kindhearted, goodnatured, generous, well-disposed people, in the main.

THE RUSSIAN MACHINERY TRADE.

We have been hearing very much of late about the prospect for trade in machinery in Russia, and, in fact, a good deal of American machinery has been sold here during the past year or so, and it seems probable that much more of it will be; but here again comes one of those curious contradictions which one constantly encounters here, and I find men apparently equally well informed and competent to speak upon the subject, some of whom think little more of foreign machinery can be sold here; while others declare their belief that very much of it will be sold here, and that the trade will develop and continue for a long time.

Russia, like most other countries, favors its own industrial establishments; and as the government owns the railroads, and is at present constructing the Siberian railways, which will be 10,000 versts, or about 6,660 miles, long, exclusive of tributary lines, this circumstance is of great importance; and, coupled with the fact that there is a heavy import duty and necessarily high transportation charges, makes the importation of the heavier machine tools rather difficult. The situation has led to a clear perception of the fact that, particularly for heavy tools, a shop located in Russia will have a very great advantage; and a shop in which it is intended to build such tools is now being put up at St. Petersburg; the capital coming partly, or perhaps mainly, from England and the equipment from the shops of Greenwood & Batley, of Leeds. Other enterprises of a similar nature are being discussed or gotten into shape, but I am not at liberty to speak more particularly of them at present. Of course, such establishments, though built primarily with a view to government orders, will be prepared to take orders from private concerns for similar tools, and will have the advantage of location and of the tariff; but will, for a time, of course be at the disadvantage of far less efficient labor, both manual and mental, than can be had in other countries.

So far as the smaller machine tools are concerned, the case is somewhat different, and it does not seem probable that, for a long time to come, Russia can supply her own market in this line. And though the English and German builders of such tools have secured a long start ahead of us, our tools are better liked by many users here, and are gaining ground at a very satisfactory rate.

One thing is certain, and that is that there is very great room for industrial development here, and such development will take place if only the political conditions remain as favorable as at present, or improve. But a long look ahead is rather uncertain in a country whose destiny is so entirely in the hands of one man and his yet unborn eldest son.

BUSINESS METHODS.

It is perhaps more true of Russia than of any other country, that one must know considerable of its peculiarities and the methods of doing business here, before he can hope to do much with consumers direct. If one is making such machinery as can be handled by Russian dealers in machinery, he may come here and in a short time take large orders, if he happens to strike them favor-

ably; but to visit and take orders in industrial establishments, is quite a different thing, and may usually be much better left to those who are in the trade here, and who have the personal acquaintance and the special knowledge of commercial methods required and, in fact, almost always of vital importance anywhere.

BRIBERY.

Regarding the peculiar features of the machinery trade here, one hears very many queer stories, some of them directly contradictory of each other. To begin with, much is said of the alleged fact that, little can be done unless one spends a good deal of money in bribery of various officials or of engineers of private establishments, who may have to do with the placing of orders, with the inspection of the goods when delivered or their acceptance after inspection, and the fact that sometimes three different men are concerned in these three stages of machinery purchasing does, undoubtedly, sometimes create difficulties hard to surmount. But, on the other hand, there are those who maintain that the amount of bribery necessary to do business is very much exaggerated by some of those who are in the business, with the object of securing, by such exaggerated representations, extra large discounts or direct payments of money for corrupt purposes; which extra discounts and payments never go further than the middleman's pocket. I expect there is some truth in both sides of this story, and, in fact, can speak with some certainty regarding the first mentioned side of it.

GOVERNMENTAL CONTROL.

Some of the difficulties encountered seem to be those always more or less incidental to government control of industrial operations; but others are exactly paralleled by the experience of those who have to do with railway matters at home, where there is no government control. For instance, I heard of one man here in charge of a mechanical department, who wanted, for that department, a certain fine lathe, quoted at a price which he knew would not be sanctioned by the officials above him. So a requisition was made out for certain lathe parts, which parts were furnished separately, and a bill made out for each one; the aggregate amount being equal to the price of the machine. The parts were supposed to be required for repairs and renewals, but upon arrival were promptly assembled, and a new lathe thus secured. Some of our American railway men in the mechanical departments cannot even get parts for repairs, and must in some cases build their own tools and charge their really heavy cost to running repairs, distributing it as best they may.

GOOD AND BAD ESTABLISHMENTS.

The character of industrial establishments differs very much here. Some of them, especially in and around St. Petersburg, are splendidly built and equipped, particularly where they are owned by the government, and are engaged in building naval vessels and making guns or armor plate. The Baltic Works, which is a government institution and builds naval vessels and engines for them, is one of the best constructed and equipped establishments of the kind in the world, and the naval works called the Ocorechovsky Steel Foundry, where guns, armor plates and heavy steel castings are made, is at present adding to its previous excellent equipment an hydraulic forging press capable of exerting a pressure of 8,000 tons.

Owing to the length and severity of the St. Petersburg winters, their vessels must be constructed under cover, and some of the buildings that have been built for this purpose on the Neva are exceedingly imposing.

There are also some very good private establishments, especially those which are under English and Scotch management; but in strong contrast to them are others, which seem to disregard every principle and precept of a successful manufacturing establishment. I went through one such establishment which carries on a large variety of work, and has done so for many years, and in which no effort seems ever to have been made to construct decent roads from one part of the plant to another, and the material which must be drawn by horses is, in wet weather, pulled through mud which seems to be wellnigh bottomless; while cinders, slag and other good road-making materials are carted away to get rid of them. This example of "management" seemed characteristic of the place throughout. They actually seemed, in many of their operations, to be going out of their way to avoid having things right.

In another place I visited an old-established car-building works, and as I entered the wood-working department I noticed the absence of the familiar hum and whirr which we always instinctively associate with wood-working machinery. Then I noticed that all the machines were driven at about half the speed we would drive them at home, and when the engine room was reached, found the engine, which was about 30-inch stroke with 16-inch or 18-inch cylinders, double, making 38 revolutions per minute, or at least as near to that speed as the engineer could keep her by manipulating the throttle valve—the governors not being in use at all. In fact, the belts were thrown off from them, and they looked as though they had not run for years; and the engineer said, in reply to a question, that the governors had not been used for a long time because they were no good. Why this condition of affairs obtained is, of course, a mystery to me; but I think someone—perhaps the engineer and perhaps someone else—had simply concluded that the speed ought to be reduced, and there was no one to say him nay. But cars were actually being manufactured under those conditions, at a cost which, presumably, afforded a profit.

A DEVOUT PEOPLE.

One thing which the best and the worst Russian shops are sure to have in common is shrines.

The Russians are exceedingly devout, and their churches and shrines are everywhere; in business offices, stores and shops, a shrine is always to be seen, and its presence is always recognized by every Russian by certain prescribed bowings of the head, touchings of the forehead and crossings of the breast. In Moscow, particularly, this keeps the droshky drivers and others pretty busy; and in manufacturing establishments there is usually a shrine at the main entrance, and one or more in every room about the place. As the men file in or out at the beginning or end of the day, they all go through certain motions, and to see so many of them silently doing this in concert is strongly suggestive of a deaf and dumb asylum. Some of the government shops have very beautiful and elaborate shrines, while others are the simple and poor things put up by the workmen themselves in the rooms in which they work; but all are equally revered and sacred to them. A lamp perpetually burns in front of every one of them, and no workman commences work in any room without first propitiating the mysterious power which he believes preserves him from even greater ills than fall to his present lot, which, to one accustomed to a different order of things, seem unbearably great as it is.

But the Russian workman is a stolid fellow, and apparently pays little attention to anything but his own thoughts, if he has any. He will bear abuse, but cannot be driven out of his regular pace, which is born of his diet of tea and black bread, and his knowledge that these are about all that life can ever mean to him. One who attempts to drive him beyond this pace usually can perceive no evidence, by even the slightest change of countenance, that he is even heard. The Russian workman has a keen sense of justice in some matters, however, and when he knows he is at fault, will take punishment for it without complaint; but if blamed or punished unjustly, he holds a grudge against his oppressor for a long time, and seeks an opportunity for getting even. His conscience can be appealed to, and a gang of workmen can often be very much accelerated in their movements by making them see, for instance, that they are working on a repair job which, while it is delayed, is keeping many other men out of work. They seem, however, to be incapable of anything approaching really hard labor for any considerable length of time, and if for any reason they do such labor, they must, after a short time, sit down and rest and drink more tea. It

seems to be true of men as of engines, that more cannot be gotten out of them in work than is put into them as fuel.

WAGES AND HOURS.

The wages of machinists here are about 2½ roubles, or $1.25, per day of 14 hours, and the moujiks usually earn, as laborers, about ½ rouble, or 25 cents, per day. A law has, I understand, been recently enacted reducing the day's labor to 11 hours.

CHARACTERISTICS.

There seems to be in the Russian character a certain element of childishness. If you do not give a droshky driver as many copeks as he thinks he should receive, he is likely to whimper and beg for more.

In Sormovo a moujik was trying to lead a pig, and the pig, as pigs do everywhere, was trying, with fairly good success, to go in the opposite direction. The moujik finally tied the rope to a wheelbarrow, thinking, evidently, that as he could propel a wheel-barrow, he could propel one with a pig attached.

Another one was working on a roof, and his box of tools kept sliding down, and he kept pulling it back until finally, losing patience, he jumped into it, thinking to thus demonstrate his ability to hold it still, and had time to think other things after he had disentangled himself from the saws, hatchets and other things that accompanied him in his flying leap to the earth.

St. Petersburg, though a large city, is, in a sense, a village, and gossip is quite prevalent in it. If you make inquiries about the standing or reputation of a certain man or firm, half of those who give you information will praise him highly, and the other half as roundly condemn him. Upon further inquiry, you find that these opinions are based upon business connections or upon business jealousies, and you are at a loss as to what conclusion to come to. In most large cities of the world, a business man can do business and retain the wood will, and even the friendship, of his competitors. This is said to be practically impossible in St. Petersburg, and men of experience here say that where one's business is likely to be of sufficient importance or magnitude to warrant it, the best plan for beginning it is to secure as manager some stranger who has had no opportunity for making enemies. The first year or so he will do little; but after a time, if he is the right sort of man, he will do well.

SLOW MOVEMENTS.

Russians seem to have relatively little appreciation of the value of time. Express train speeds are about 20 miles an hour; but for such speeds you pay extra. It is cheaper, if you can spare the time, to travel by their slow trains. Telegrams go slowly; both these and the letters of foreigners being delayed somewhat by the fact that the addresses of letters and the whole of telegrams must be translated into Russian before transmission; the fact that Russians do not use even the same alphabet used by the rest of Europe making this translation necessary.

A Russian who proposes to buy anything seems willing that those who have that thing to sell shall devote any amount of time to the selling of it, and will see them put to inordinate expense, only to be thrown overboard finally, apparently without compunction or other thought than that such is the way of regular business; as, in fact, it is with him. An engineer attempting to secure orders for an installation of any kind is liable to be asked to make working drawings of subsidiary or connected structures, which he does not propose to furnish, and the making of them (if he makes them) gives him no guarantee whatever that he will secure an order.

THE SORMOVO WORKS.

American machinery men are, of course, all interested in the new locomotive plant at Sormovo, which is on the Volga River, about seven miles north of Nijni Novgorod; the latter place being a night's journey (for a Russian express train) east of Moscow. The Sormovo Works is an old establishment which has built steamboats and railroad cars for many years, and has had a varied career, with alternate periods of good and bad management, with attendant prosperity and adversity. At present it is being improved throughout; the evident intention being to eventually have an essentially new plant; and the locomotive-building part of the business, which is under the direction of Mr. W. F. Dixon, formerly of Paterson, N. J., is entirely new, no locomotives having previously been built there. American tools to the value of $375,000 have been put in here, and the plant will be a model one in every respect. At the time of my visit to the place, some of the smaller tools were in operation, driven by temporarily placed electric motors, and in a few days work on actual locomotive building will commence, though there is still much to do before the plant is complete in every respect, ground having been broken for the main building just about a year ago. When completed, we shall probably be able to give some further account of it.

VALEDICTORY.

Before this letter can appear in the columns of the "American Machinist," I shall, I hope, be again at home. Here in Russia, as in every other country I have visited, I have seen much that would interest our readers if it could be properly presented to them, and I expect to be able by aid of photographs and drawings to go more into details regarding some of the things I have seen, which, because they interested me very much, I feel warranted in assuming will interest others. These will appear in detached and independent articles as opportunity offers; this being the last of this series of letters, which have been intended merely to give a general idea of the state of things mechanical in foreign lands. If I have succeeded in transferring to my readers even a small part of the interest awakened in myself by what I have seen, I shall be more than satisfied.

In closing, I feel impelled to return my most heartfelt thanks to the very many friends I have met in every land—friends who have in many instances gone out of their way to help me. Not only in the industrial establishments of Europe, which I visited with a more or less specific introduction, but in railway trains and everywhere I constantly met people who patiently helped me over threatened difficulties arising from differences of language and customs. To the known and to the unknown friends who everywhere have exhibited that kindness of heart and sympathetic interest which, after all, are predominating traits of human character everywhere, I here return my most sincere thanks.

F. J. M.

Moscow, July 10th.

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That Pattern-Making Wrinkle.

In a recent issue a correspondent described as "a pattern-making wrinkle," attributing it to Japan, the method of making a pattern of wax, enclosing it in a mold of plaster or other refractory material, melting out the wax and then using the mold for making a metal casting. We have since found in "Indian Engineering" a description of a similar process in common use in India. The description says:

"In up-country districts, the methods of the village molder (who is generally a blacksmith) are most interesting. Having made a model of the article required, in bees-wax, he prepares his mold in the following ingenious way: First of all he gets some suitable clay and hammers it well, to break up any lumps or pieces of gravel. Having got it into a nice plastic state, he covers his wax model all over with this clay about an inch thick, but leaves a hole on top like a molder's 'gate.' The mold is placed in the sun to bake for a few hours, then placed near the fire, and heated sufficiently to liquefy the wax. The wax is now poured out through the 'gate' and his mold is ready for filling. The disadvantages of his method are that a fresh pattern is required for every casting, and that cores cannot very well be used. The success of the great iron-founders of Europe is in a measure due to the excellence of the patterns they use; in India the very inferior sorts of castings that one finds, are due, to a great extent, to badly made patterns."

If this is a pattern-making wrinkle, it is apparently wrinkled by age.

Most Economical Cut-off.

Fig. 1 is a graphical table or diagram, showing the results of some well-known experiments of Professor Denton, with a 17 x 30-inch simple, non-condensing, double-valve engine, to determine the relation of steam consumption to point of cut-off.

The line *A B* represents the stroke of the engine. This is equally divided into tenths and half-tenths to denote the various points of cut-off, or periods of admission. Above these points are laid off to a scale of 20 pounds per inch, the actual pounds of water used per horse power per hour. Through these points a curve is drawn, from which may be seen more clearly than from a numerical table, the change in rate of water-consumption corresponding to changes in point of cut-off. Three of these curves are shown, corresponding to 90, 60 and 30 pounds boiler pressure, respectively.

It will be seen from the curves, that the best result for 90 pounds pressure was obtained at about ¼ cut-off; that for 60 pounds, at about 33-100 cut-off, and that for 30 pounds, at about 45-100 cut-off. For a short distance each side of these points of cut-off, the economy is practically the same, but in case of very early or very late cut-off, the water consumed is considerably increased.

The relation of economy to cut-off is well pointed out by these experiments, but the actual water rates would have been somewhat better but for the fact that the engine had uncommonly large clearance. Had the clearance been as small as might be, the results would probably have been about 3½ per cent. more favorable, or at 90 pounds pressure, ¼ cut-off, about 26 pounds consumption; at 60 pounds pressure, 35-100 cut-off, about 30 pounds; and at 30 pounds pressure, ½ cut-off, about 41½ pounds, which amounts correspond to good performance.

In some similar experiments with a small (7 by 14) Buckeye automatic non-condensing engine, boiler pressure 75 pounds, the same experimenter has found the best rate of consumption to be 30 pounds at about ¼ cut-off. We see here that the most favorable point of cut-off is the same in small as in large engines, while the matter of economical use of steam is in favor of the larger engine and high pressure.

It should be borne in mind that these results are deduced from refined tests, extending over a considerable period, the engines being in perfect condition as to leakage, etc., and the steam collected, condensed and carefully weighed after the work was performed, thus eliminating errors as far as possible. The steam was also practically free from moisture. In the tests giving the results represented it contained less than one per cent.

From these and other experiments we are able to formulate the approximate rule that the best cut-off, expressed in fractions of the stroke, may usually be determined by dividing 100 by 42 times the square root of the initial pressure—this pressure being reckoned from a vacuum for condensing, and from the atmosphere for non-condensing engines.

Fig. 2 illustrates the action of steam in two cases in which the cut-off agrees with the above rule. The full lines refer to a non-condensing engine using steam at 80 pounds pressure, and the dotted lines to a condensing engine using steam at 100 pounds pressure.

The steam is discharged in each case at about 27 pounds total pressure, and notwithstanding the amount of work contained in the steam at this pressure, it is found more economical to throw away this work, than, owing to cylinder condensation, to reduce it by further expansion in a single cylinder. Some of it may be economically saved, however, by compounding.

If we assume the steam in the high-pressure cylinder of a compound to be used between 100 pounds and 15 pounds (above atmosphere), which is about the case in our engines when using steam at 100 pounds initial pressure, then by the above rule, the best cut-off is ¼. We usually made it 3-10, as being a near enough approximation. Assuming the steam in the low-pressure cylinder to have an initial pressure of 30 pounds above a

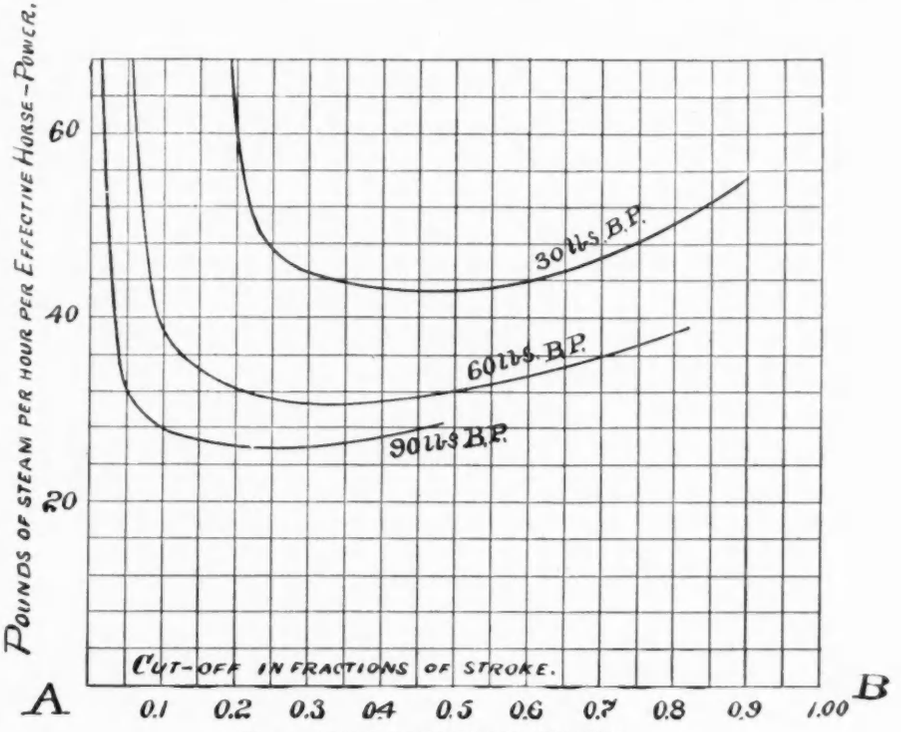

Fig. 1. MOST ECONOMICAL CUT-OFF.

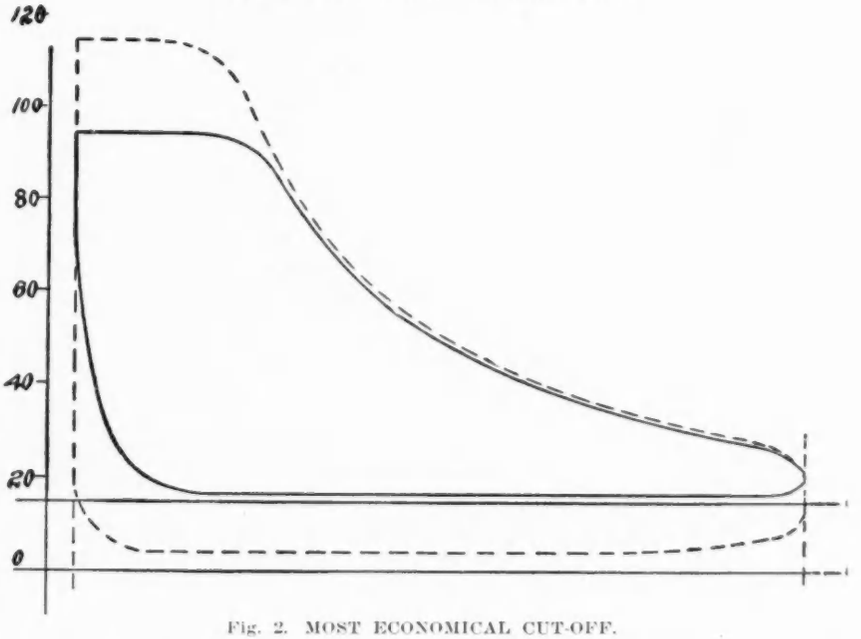

Fig. 2. MOST ECONOMICAL CUT-OFF.

vacuum, and using this value in the same rule, the best cut-off appears to be 43-100. We make it about 4-10, as being a good enough approximation, and because this cut-off better equalizes the load of the cylinders.

Referring again to results of tests illustrated by Fig. 1, we find that a 3-10 cut-off and 90 pounds pressure (which corresponds to about the same range of temperature as that occurring in our high-pressure cylinder), a horse-power per hour was obtained at an expense of about 26 pounds of water, while with a performance similar to that shown by our low-pressure diagram, 42 pounds of water produced a horse-power per hour.

Now, other conditions being the same as in these experiments, we may conclude that the horse-power per 42 pounds of water is the amount gained by compounding, condensing and increasing the boiler pressure from 90 to 100 pounds, with the specified relation of cut-offs and capacity of cylinders. We therefore gain by compounding, for every horse-power which would be obtained by the simple non-condensing engine using steam at 90 pounds, 26-42 of a horse-power, or in decimals, 0.62 of a horse-power; which means that 1.62 horse-power is produced in the compound with 26 pounds of water per hour, or 1 horse-power with 26 divided by 1.62, equal to 16.05 pounds of water. This result agrees fairly well with the actual result realized in practice under the conditions assumed.—Advance sheets Buckeye Engine Company's Catalog.

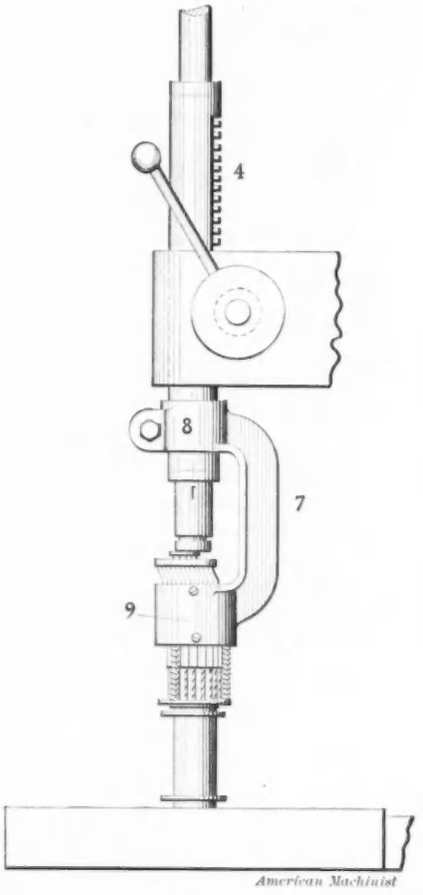

Fig. 1
MULTIPLE DRILLING.

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Multiple Drilling Attachment.

We illustrate a neat device for the simultaneous drilling of any number of small holes. It is shown, in Fig. 1, in the act of drilling at once all the spoke holes in one flange of a bicycle-wheel hub—a job for which it is well adapted, although equally so for many other articles. The holes to be drilled, by the way, may have any position or arrangement, symmetrical or otherwise, with regard to each other, instead of being, as in this case, arranged in a circle.

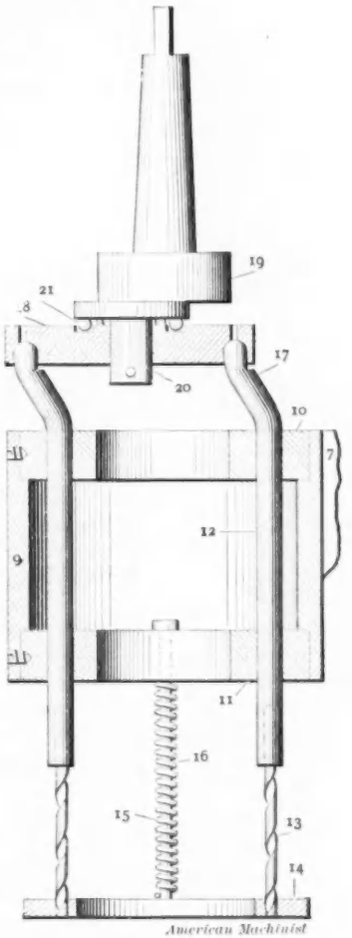

Fig. 2
MULTIPLE SPINDLE DRILL.

In Fig. 1, the bracket 7 is fastened to the feed sleeve 4 of a "sensitive" drill by means of the split hub 8. The lower hub 9 of the bracket is shown enlarged in Fig. 2. At the top and bottom of hub 9, plates 10 and 11 are set in and fastened by set screws. These plates have corresponding holes in which revolve the several little drill spindles 12, one for each drill, the drills being soldered in. The upper ends of these little drill spindles are bent to form cranks, each having the same throw and terminating with a hemispherical top. Where the spindle turns over from the straight to form the crank, there is sufficient shoulder formed on one side to hold the weight of the spindle and drill. The upper ends or crank pins of the drill spindles are all of the same hight, and they fit into holes in the pressure plate 18. This plate also has a larger hole for the crank pin 20 of the driver 19. The taper shank of this driver fits the hole in the spindle and turns with it. The crank pin then gives orbital movement to the pressure plate 18, and all the drills revolve. Between the crank-pin collar 21 and the pressure plate 18, balls are placed to take the downward pressure when drilling. This pressure comes upon the hemispherical tops of the drill spindles, oil holes being provided for each.

The guide or jig 14 is held by three or more stop pins and push springs. Its normal position is just below the points of the drills, and as the drilling proceeds, the springs enable it to yield; and when the drills are withdrawn, the plate resumes its original position. When drilling bicycle hubs, the centering plug 23, Fig. 3, is used. This is fixed in the plates 10 and 11, and is long enough to extend some distance into the hub to be drilled. This device was recently patented by Hugh L. Warner, Hamilton, O. The attorney in the case, we notice, was James W. See, of the same place, so renowned among readers of the "American Machinist" as "Chordal."

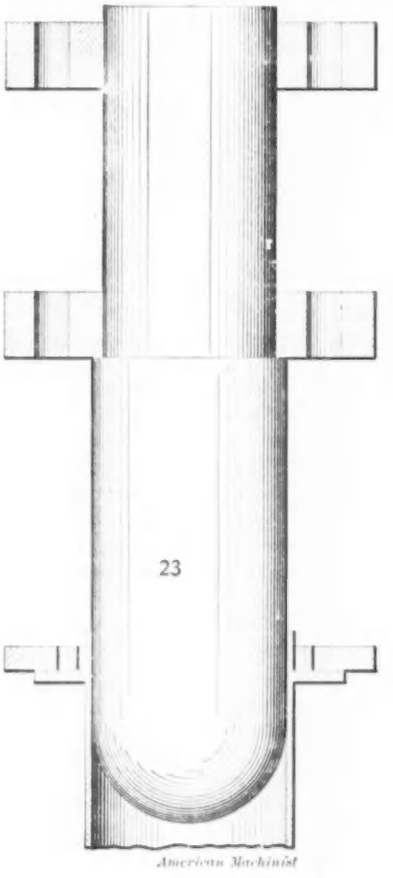

Fig. 3
CENTERING PLUG.

The Place of Our Destination.—VI.

Editor American Machinist:

FEEDING LONDON.

Among the many questions that confront one in London not the least is, How in the world do they feed all the people? When I first knew London, Smithfield was a great open field, with pens for cattle, pigs and sheep. Now a great market building covers the whole space. Covent Garden then was the great market-place, covering a square or two. Now it has so overgrown these limits that all the streets for blocks in every direction, up to 8 or 9 o'clock in the morning, are blocked with market carts. Where does everything come from? Even the flowers were a question until one found on the way to Cambridge a hot-house a mile in length and some hundreds of yards wide. The country is fine and well cultivated, a word our farmers, I believe, do not know the meaning of. This, no doubt, will seem to all your readers as a libel on the greatest, or what we claim the greatest, agricultural country of the world; but with us crops grow without cultivation, except to a limited extent, and here they raise large crops on soil that has been used for centuries, by enrichment and cultivation.

THE COLLEGES AT CAMBRIDGE.

At Cambridge the sights to see are colleges—first a college, then another college, then some more colleges—and I was led to wonder where the money all comes from to build and maintain them. The same as in our country perhaps, from the Coopers, Cornells and Carnegies, or others who have amassed fortunes by hard work. I often wonder if the scholars of these colleges ever look upon themselves as subjects of charity, or if the alumni give back to someone the equivalent for what they have received. Usually it seems as if they charged extra for the education that had been given them.

To use the slang expression, one would think that Cambridge had colleges to burn; but the buildings do not appear as if that is likely—many of them old enough to be historical, and all of them sacred in the eyes of the nation for scholarship, science, religion or boat-racing.

CATHEDRALS AND CHIMNEYS.

From London to Ely—a city not because of its size, but because it has a cathedral. Every cathedral town is a city, or at least it so used to be, that no town however large was a city unless it had a cathedral. The Cathedral of Ely ranks among the largest and most wonderful, but to me they are all wonderful. They are each built on the remains of an old one, and yet all so old! There are here and there parts of the old welded to the new. As there are parts of the old Roman at St. Albans, so too in Ely there are bits of the Saxon, great sections of the Norman, surmounted by different periods of Gothic. Whether a building is three hundred or ten hundred years old, it is all so old to us that the difference only impresses us as we compare the periods of progress. The old is simple and grand; the new fine and gorgeous. The Lady Chapel at Ely, a room 50 x 80 feet or so, was lined with white marble, and with the entire surface carved in the most wonderfully delicate manner; the work as fine and delicate as would now be made of wood for cabinet work. Thousands of figures of such a size that the faces were one or two inches in length; the figures set in niches with carved lace-work canopies, etc. During one of the wars the soldiers amused themselves by knocking off the heads of these little figures, till but one or two were left. The most able architects estimate that to restore this chapel to its original, as near as modern sculptors could reproduce the work of the Fourteenth Century artists, would cost a million dollars, and when one realizes what it would be to put a million dollars worth of work on the interior of a room of that size, he can imagine something of its delicacy.

One thing besides that we saw that pleased me at Ely, was a brick chimney, that was perfect in its proportions and finish. When one has had his hand at designing anything he is pretty sure to observe everything of the kind that comes in his way, particulary so, if he feels he has rather made a failure of it himself. So I always observe chimneys, and this at Ely is the one of all that there was nothing to knock off or put on to make it better. I think I could mark it out on a drawing board as it looked to me—but how to build one so it would look when finished as it does in the drawing is what few can do. When an architect sees executed his first church spire it is likely to look to him as if someone had sat on it, and so too with a tall chimney—it is not likely to look like the picture. There is an underlying principle that governs, in a measure, or by which one may be governed in such matters, and this may be a good illustration. A column is a support; if it has a light load to carry the top of the column itself is a part of the load, and the column should taper. If, as is the case in a Gothic structure, the load is so great that the column is insignificant, the column needs to taper only so as to appear parallel. A spire is nothing but a roof to a tower; a chimney or stack is neither. It needs to taper, and ⅜ inch to the foot on each side is correct when the diameter is in proportion to the hight. A chimney with this taper can no more be made to look right without a projecting cap than can a building without a cornice, and the cap does not look right if made like the capital of a column, which has a load to carry while the chimney has none.

Continuing our side trip from Ely to Norwich, we got far enough north to get into a pine section where they were making pine lumber from what would seem to us simply poles. The sights at Norwich are, a great tower on a hill, something like 200 feet square and 60 feet high, built for defense, but now a museum, and the cathedral. Still another unlike the rest, except all Norman at the base, surmounted by Gothic of a later date; very lofty inside, and beautifully arched overhead, with one of the tallest spires in England, set over the intersection of nave and transept. While the columns that support the great roof are not alike, they are in pairs—some square, with half-round projections; some clustered columns, and one pair, two huge round ones, richly ornamented.

YARMOUTH AND IPSWICH—AGRICULTURAL MACHINERY.

Great Yarmouth, on the East coast by the North Sea, is a great summer resort, with miles of sandy beach; a fishing place, and a place from where "men go down to the sea in ships." Returning to London by the East Coast Railway to Ipswich, I responded to an invitation to visit the works of Ransom, Sims & Jeffries, where they employ some 1,500 men and lads in building agricultural tools and machinery, such as plows, threshing machines, lawn mowers and engines of various kinds—threshing engines, portable and traction; small high-speed vertical, for direct connection to dynamos, and Corliss engines. They build for all the civilized countries except the United States, and particularly plows, having patterns for 1,000 kinds, making 5,000 different pieces of plow patterns; and carry a stock of 750,000 pieces, which I could easily believe, in going through the store room. Their foundry, which covers an acre of ground, has six cupolas, three of which run continuously from morning till night. They use molding machines quite extensively, though these things are nothing new in England, for to my personal knowledge, over thirty years ago, at Birmingham, they ran furnaces continuously, making railroad chairs, of which enormous quantities have always been used (they use a chair to every tie). They were all molded by machinery of the most ingenious description, and in some cases the sand was rammed by power.

At these works the erecting shop is 240 x 300 feet; the boilers for portable engines are of the locomotive type, splendid pieces of boiler work, and I noticed the man-holes were on the side, just above the tubes. Whether from necessity to get out of the way of the engines which are on top or not, I don't know; but certainly it seemed to me a very convenient place for a man-hole.

Unfortunately I had but an hour and a half to look around in, where I could easily have spent a day and made a complete letter out of the things worth describing.

THE OLIVER—MAKING HEXAGON NUTS.

In all the English works they make great use of what is called an Oliver. It's

a machine half-way between a hand sledge and a Bradley hammer; two or three sledges of different weight hung so as to strike on the anvil in fixed positions and operated by the smith by pedals. There is a certain class of forging in which nothing else can compete—when the piece is small and needs to have a lick with a hammer, and is changed to two or three different dies during the operation. Complicated pieces forged from 5/8-inch round iron, cost but two or three cents a dozen. They could not be forged by hand on a Bradley hammer for that much apiece.

In going through the machine shop I caught a glimpse of a cute way of dressing up the sides of hexagon nuts in a lathe. A mandrel, as shown in Fig. 1, had at its center a plate about the thickness of the nuts to be dressed. This plate was several sided, as shown in Fig. 2, with gaps to receive short mandrels on which were secured several nuts, say, five or six. With six of these mandrels with six nuts each, thirty-six nuts were operated upon at each revolution of the lathe, with two tools set at the proper distance

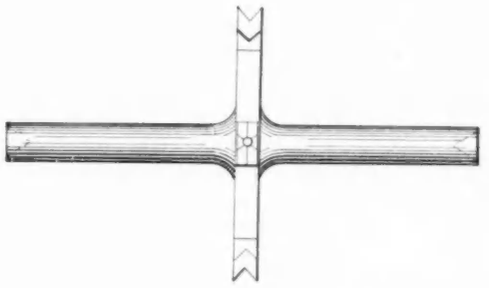

Fig. 1

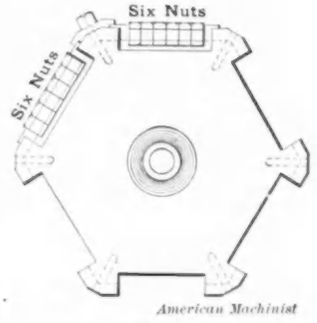

Fig. 2

DRESSING HEXAGON NUTS.

apart; the nuts were brought to size, at least to the proper wrench size, though not necessarily perfectly hexagon, owing to the spring of the mandrels and other errors, though not important in agricultural machinery. Just what means they had for spacing the hexagon, I do not know; but a hexagon on one end of the mandrels entering triangular sockets would be a good arrangement. The method I have sketched would do.

They were building shell boilers to go to some foreign country, that would be taken apart for mule transportation. The boilers were in short sections, flanged out at the ends, and set end to end with the flanges bolted together with asbestos packing; also boilers and engines for the oil-well trade for Russia, of the class and in competition with the Erie people.. I left the works of Messrs. Ransom, Sims & Jeffries with regret at not being able to make a more full report while acknowledging the very courteous treatment I received. A brisk ride brought us back to London.

JOHN E. SWEET.

Current Practice in Engine Proportions.

Among the papers presented at the Hartford meeting of the American Society of Mechanical Engineers, that with the above title, by Professor John H. Barr, of Cornell University, represented a vast amount of labor in the collection of data, and in the condensation and preparation of the same for practical service. The length of the paper will not permit of its presentation in our columns, but it occurs to us that some of the results as summarized in the paper may be profitably preserved apart from the paper as a whole. The results are derived from about eighty separate high-speed engines and about eighty-five low-speed engines, the former ranging from 20 to 240 horse-power and representing the practice of thirteen builders; the latter, from 45 to 740 horse-power, and representing twelve builders.

The following notation is used throughout the paper:

D = diameter of piston; A = area of piston; L = length of stroke; S = steam pressure, taken at 100 pounds per square inch above exhaust, as a standard pressure; $H.\ P.$ = rated horse-power; N = revolutions per minute; C = a constant. All dimensions in inches, unless stated to the contrary. Other notation is explained as it occurs.

Thickness of Cylinder Walls.—The general practice for the thickness of the cylinder shell is $.05\,D + .3$ inches.

Flanges and Cylinder Heads.—The flanges of the cylinders and the cylinder heads usually have the same general thickness. This varies from 1.0 to 1.5 times the thickness of the shell, the mean being 1.2.

Cylinder Head Studs.—The diameters of studs used vary from 3/4 inch to 1 3/8 inches. The least number is 8 for a 10-inch cylinder, and the greatest number is 32 for a 24-inch cylinder. The average number of studs used is $.7\,D$, or the nearest even number to that, and the general practice as to stud diameter is

$$\frac{D}{40} + \tfrac{1}{2} \text{ inch.}$$

Ports and Pipes.—The relation of port or pipe area to area of piston is expressed by

$$a = \frac{A\,V}{C}$$

a being the area of port or pipe in square inches, V the velocity of the piston in feet per minute, and C the mean velocity of steam through the port or pipe in feet per minute. The following values of C are then obtained: High-speed engines, steam and exhaust ports, mean 5,500, maximum 6,500, minimum 4,500; low-speed engines, steam ports, mean 6,800, maximum 9,000, minimum 5,000; low-speed engines, exhaust ports, mean 5,500, maximum 7,000, minimum 4,000; steam pipes, high-speed engines, mean 6,500, maximum 7,000, minimum 4,800; steam pipes, low-speed engines, mean 6,000, maximum 8,000, minimum 5,000; exhaust pipes, high-speed engines, mean 4,400, maximum 5,500, minimum 2,500; exhaust pipes, low-speed engines, mean 3,800, maximum 4,700, minimum 2,800.

Face of Pistons.—For high-speed engines the mean width or face of pistons is $.46\,D$, maximum $.60\,D$, minimum $.30\,D$, and for low-speed engines it is, mean $.32\,D$, maximum $.45\,D$, minimum $.25\,D$.

Piston Rods.—The diameters of piston rods of high-speed engines are: Mean, $.145\sqrt{D\,L}$; maximum, $.175\sqrt{D\,L}$; and minimum, $.12\sqrt{D\,L}$. For low-speed engines the diameters are: Mean, $.11\sqrt{D\,L}$; maximum, $.13\sqrt{D\,L}$; and minimum, $.10\sqrt{D\,L}$.

Connecting Rods.—For the connecting rods of high-speed engines only those of rectangular section are considered:

Mean thickness of rod $= .057\sqrt{D\,L_1}$;
Maximum " " $= .07\sqrt{D\,L_1}$;
Minimum " " $= .045\sqrt{D\,L_1}$.

L_1 is the length of the rod, usually $3\,L$. The mean hight of the rod section is the thickness, as above obtained, multiplied by 2.7; maximum by 4.0, and minimum by 2.2.

For the connecting rods of low-speed engines, only those of circular section are considered:

Mean diameter of rod $= .092\sqrt{D\,L}$;
Maximum " " $= .105\sqrt{D\,L}$;
Minimum " " $= .082\sqrt{D\,L}$.

Crosshead Shoes.—For high-speed engines the mean pressure allowed per square inch of shoe, where the pressure is greatest, near midstroke, is 27 pounds, maximum 38, minimum 10.5. For slow-speed engines the mean pressure is 40 pounds, maximum 58, minimum 29.

Crosshead Pins.—The mean projected area of the crosshead pin for high-speed engines is $.08\,A$, maximum $.11\,A$, minimum $.06\,A$, and the mean ratio of length to diameter is 1.25 : 1, maximum 2 : 1, minimum 1 : 1. For low-speed engines the mean projected area is $.07\,A$, maximum $.10\,A$, minimum $.054\,A$, and the mean

ratio of length to diameter of pin is 1.3 : 1, maximum 1.5 : 1, minimum 1 : 1.

Crank Pins.—For the projected area of the crank pin, the mean for high-speed engines is $.22\,A$, maximum $.4\,A$, minimum $.1\,A$, and for low-speed engines it is $.09\,A$, maximum $.115\,A$, minimum $.065\,A$. The expression for the mean length of the crank pin is, for high-speed engines:

$$.30\,\frac{H.\,P.}{L} + 2.5 \text{ inches};$$

$$\text{Maximum, } .46\,\frac{H.\,P.}{L} + 2.5 \text{ inches};$$

$$\text{Minimum, } .13\,\frac{H.\,P.}{L} + 2.5 \text{ inches};$$

and for low-speed engines:

$$.60\,\frac{H.\,P.}{L} + 2 \text{ inches};$$

$$\text{Maximum, } .80\,\frac{H.\,P.}{L} + 2 \text{ inches};$$

$$\text{Minimum, } .4\,\frac{H.\,P.}{L} + 2 \text{ inches.}$$

Crank Shafts, Main Journals.—For the projected area of the main journal of the crank shaft, the mean is, for high-speed engines, $.46\,A$, maximum $.70\,A$, minimum $.37\,A$, and for mean low-speed engines, $.56\,A$, maximum $.64\,A$, minimum $.46\,A$. The mean diameter of the main journal for high-speed engines is:

$$7.3\sqrt[3]{\frac{H.\,P.}{N}}$$

$$\text{Maximum, } 8.5\sqrt[3]{\frac{H.\,P.}{N}}$$

$$\text{Minimum, } 6.5\sqrt[3]{\frac{H.\,P.}{N}}$$

and for low-speed the mean is:

$$6.8\sqrt[3]{\frac{H.\,P.}{N}}$$

$$\text{Maximum, } 8.\sqrt[3]{\frac{H.\,P.}{N}}$$

$$\text{Minimum, } 6.\sqrt[3]{\frac{H.\,P.}{N}}$$

The length of the main journals of high-speed engines is:

Mean.....Diameter of journal × 2.2
Maximum..Diameter of journal × 3.
Minimum...Diameter of journal × 2.

and for low-speed engines it is:

Mean.....Diameter of journal × 1.9
Maximum..Diameter of journal × 2.1
Minimum...Diameter of journal × 1.7

Piston Speed.—The mean piston speed for both high-speed and low-speed engines is the same, 600 feet per minute, the maximum for the high-speed being 660 and the minimum 530; while for the low-speed engines the maximum is 850 and the minimum is 500. The long stroke of the low-speed engines compensates for the revolutions of the high-speed engines.

Weight of Reciprocating Parts.—The mean weight of the reciprocating parts of high-speed engines is:

$$1{,}860{,}000\,\frac{D^2}{L\,N^2}$$

$$\text{Maximum, } 2{,}300{,}000\,\frac{D^2}{L\,N^2}$$

$$\text{Minimum, } 1{,}200{,}000\,\frac{D^2}{L\,N^2}$$

No figures are given for low-speed engines.

Belt Surface for I. H. P.—For high-speed engines the number of square feet of belt surface per minute per unit of horse-power is: Mean 55, maximum 70, minimum 40. For low-speed engines it is: great difference here is attributed to the fact that the high-speed engines use thinner and lighter belts.

Fly-Wheels.—The weight of fly-wheel rim, for high-speed engines only, is: Mean 35, maximum 42, minimum 30. The

$$\left.\begin{array}{l}\text{Mean, } 1{,}200{,}000{,}000{,}000\\ \text{Maximum, } 2{,}000{,}000{,}000{,}000\\ \text{Minimum, } 650{,}000{,}000{,}000\end{array}\right\} \times \frac{H.\,P.}{D_1{}^2\,N^3}$$

D_1 is the diameter of the rim in inches; the weight of the rim is in pounds.

Weight of Engine per I. H. P.—The weight of engine per unit of horse-power for high-speed engines is: Mean 115, maximum 135, minimum 100, and for low-speed engines it is: Mean 175, maximum 240, minimum 135.

A Bicycle Hub Machine.

BY W. A. WARMAN.

Having, last spring, visited the Cleveland Hub Company's plant and seen in operation the Bardons & Oliver hub machines, naturally I was interested. The photograph Fig. 1 shows the machine as arranged for rear hubs, gear cases and oil guard removed. The drilling attachment, shown in place of the turret, is the one feature largely essential to the rapid production of hubs of which this machine is capable.

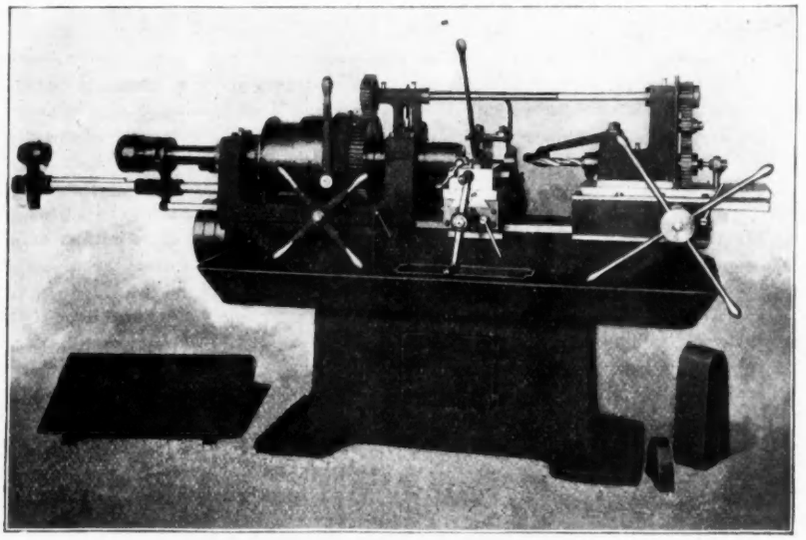

Fig. 1. BICYCLE HUB MACHINE.

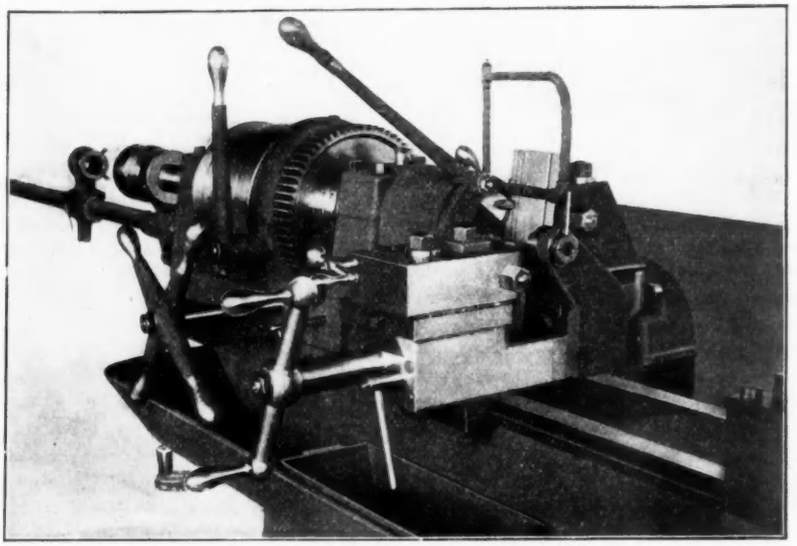

Fig. 2. BICYCLE HUB MACHINE.

The photograph shows clearly the drill-driving mechanism, change gears being provided for adapting the drill speed to suit the size of drill employed. The practice on the machines I saw in operation was 50 feet cutting speed with .0073-inch feed per revolution for 1 1-16-inch drill. The arm above the drill swings on a stud. This arm carries the adjustable gage stop to which the stock is fed. The stop which fits the drill bushing is brought

forward while the stock is fed; the slide is backed sufficiently to allow the arm to swing out of the way of the drill. After the drill is started, the split bushing, shown in the enlarged photograph, Fig. 2, is taken out to allow the chips to get away more freely. The drills are the ordinary type of twist drill with oil tubes, fed through the drill spindle.

The forming tools are carried on tool blocks fitted to a cross slide much the same in appearance as those usually found on this type of machine. The sketch Fig. 3 shows the cross slide in section. The right and left hand screws being differential, the rear tool takes the roughing cut, and the other tool merely takes a finishing scrape. This makes it possible to keep the finishing tool sharp and produces a nicely finished hub.

The rear tool is provided with longitudinal adjustment, while cross adjustment is provided on the front tool block. The differential screw has a graduated index, making the sizing of hubs, to a very low limit of variation, comparatively easy. The small crank handle shown on the upper left-hand corner of cross slide, operates the auxiliary slide for cutting off the thin shell that remains after forming and drilling. The lever on top of the front tool block carries the necking tool, necking rear hubs for the treads with the large forming tools being found impractical. With this attachment it is claimed that the forming tools do not need grinding oftener than once in one to two weeks.

The forming tools are made of "styrian" steel, extra tough and hard. The cutting speed on forming tools is 40 feet with .00166 inch feed per revolution. Cross slide feed is operated by the small handle on lower left-hand corner of cross slide.

The wire-feed mechanism on this machine, it will be seen, is operated by a cross handle within easy reach of the operator. The small handle shown on lower front corner of head controls the oil supply through a three-way cock.

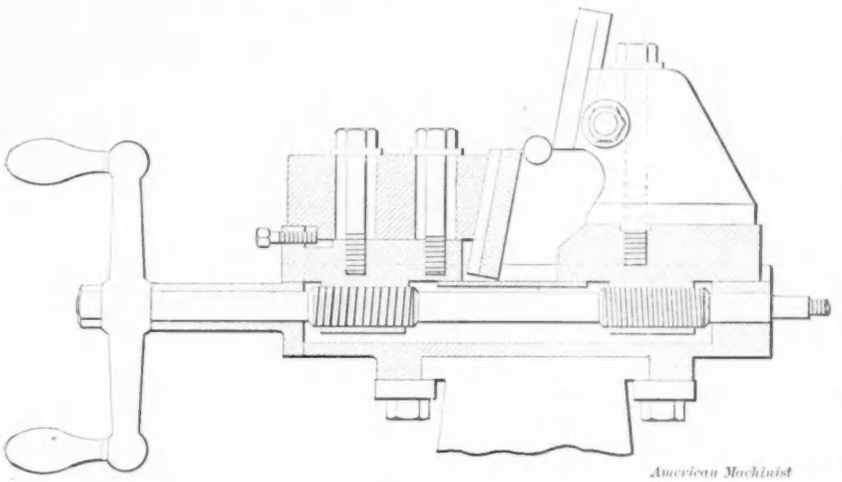

Fig. 3

REST AND TOOLS FOR BICYCLE HUBS.

Weighing the stock and finished hub I find the stock removed from each hub is 53½ ounces. Messrs. Bardons & Oliver inform me that they find it necessary to use only the very best grade of lard oil to secure the best results. The cones are so designed that the small cone gives the proper speed for front hubs, and the large one for rears.

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The Purification of Lubricating Oil.

We abstract the following practical information from an article by G. W. Bissell, Prof. Eng., Iowa Ag. Col., in "Cassier's Magazine" for June, 1897.

The purification of waste oil is extensively practical in well managed machinery concerns, but in too many small establishments no attention is given to it, and where it is practiced the success attending it varies widely. Self oiling bearings designed to secure reliability of lubrication, also to some extent act as oil purifiers. In these bearings the oil should occasionally be removed. There are many places where self oiling bearings cannot be used and here means should of course be provided for collecting the waste oil.

The impurities in such oil are mostly mechanical, but chemical impurities also occur, as free fatty acids liberated by the decomposition of animal oils, and as residue from the actual burning of the oil by excessive local pressure. These impurities affect the viscosity of the oil, the coefficient of friction, specific gravity and color. Color and general appearance of an oil are decided indications of the presence or absence of impurities. Usually the dirty oil is clouded and darkened and lacks the depth and purity of color which characterize clean oil. We may use tests for viscosity, friction or color to tell us of the purity of an oil. The color test is most convenient and is reliable, except when sal soda is used, which may darken the oil, but when darkened by this means the oil is still clear and its color deep.

Oil may be purified by settling, by percolation, by agitation, by capillarity, by centrifugal action, by chemical action, or by combinations of these, the apparatus employed for either process being usually called a filter. For purification by settling, the tanks are of large volume relative to the amount of oil in use, and of considerable depth. Almost complete purification of mechanical impurities can be accomplished by settling if time enough is allowed and if care is taken, in adding dirty and withdrawing clear oil, to disturb the contents of the tanks as little as possible.

Purification by percolation is done in filters, consisting essentially of a strainer upon which the oil is poured and through which it passes, leaving the impurities behind. The first attempts at filtering were made with strainers of perforated metal or wire gauze. They abstracted only the gross impurities. At present we find waste, hair-felt, cheese-cloth, charcoal, shavings, sponge, paper and a host of other substances serving in filters of the percolating type. The desirable material for the purpose should be dense, strong, porous, and homogeneous. In the opinion of the writer the best material is blotting paper. It possesses all of the required qualifications, except strength, and this is readily supplied by a support of wire gauze or perforated metal.

Capillary filters are those in which the oil is separated from its impurities by the capillary action of a wick of cotton, or other material. The capillary filter has certain advantages over all other types. It is impossible to rush the operation, and destruction of the wick does not result in a deluge of dirty oil into the clean oil reservoir. The wick will stand longer usage without cleaning or renewal than will the filtering medium in the percolating filter.

Purification by agitation consists in forcing the dirty oil through a body of water or in mixing the oil and water by shaking. Settling is an essential subsequent operation. The centrifugal principle can be used for the separation of oil from the impurities which are found in waste oils. The writer has used the process experimentally and with sucess, but the power required is out of proportion to the quantity of oil handled. But the method promises well for the separation of cylinder oil from condensed steam or from the drip from exhaust steam eliminators.

Chemical action may be advantageously used with most waste oils. By the agitation of the oil with a solution of sal soda the free fatty acids contained in the oil are removed. Sometimes the result is also a darkening of the oil.

Any of the above mentioned principles of purification can be followed singly with advantage by the user of oil for power

purposes, but inspection of filters on the market shows that two principles are usually employed in combination. For example, percolation is usually preceded by settling; settling is usually assisted by agitation. In all cases where settling or percolation is used, the heating of the oil is an advantage, hastening settling in the one instance and expediting the filtration in the other. The heating is most readily accomplished by performing the settling over a body of water which is heated by a coil of pipe through which live or exhaust steam is circulated.

Where agitation is employed, the oil is very effectually heated by its thorough admixture with hot water, heated as above indicated.

As to the relative merits of the devices for purifying oil, the writer, after experiment and experience with numerous filters and purifiers, manufactured and home made, as well as with special apparatus, constructed for study of specific features of the subject, has come to the conclusion that very nearly equally good results can be obtained with filters and purifiers by giving to each a fair amount of care. All forms are easily pushed beyond their capacity. Percolating filters are liable to give trouble by filling up of the filtering substance. Settling filters give poor results if large quantities of oil are fed at one time.

It would seem that all filters and purifiers should comply with the following conditions: The flow of dirty oil from the receiving chamber to the settling chamber, or from the settling chamber to the other compartments of the apparatus, should be uniform and automatically independent of the quantity of oil in either. This is best accomplished by the floating syphon. The capillary filter complies perfectly with this requirement. All percolating or filtering material should be readily and quickly renewable, and should not be special in its nature or preparation. Ordinary blotting paper for the one, and lamp wicks for the other, are excellent materials. All purifying operations should be conducted with the assistance of heat. Where oils contain animal oils, free fat acids may exist in the dirty oil, and should be removed by agitation with sal soda. All parts of the apparatus should be thoroughly cleanable, and water glasses, and bibbs provided to show the level of each mass of liquid.

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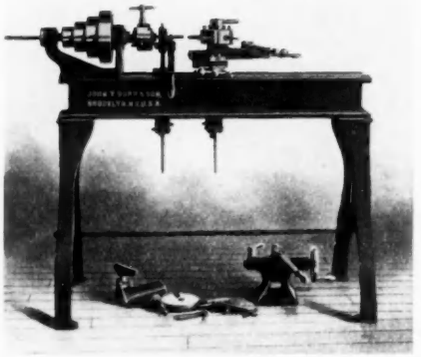
A Universal Hand Lathe.

The lathe, shown with its attachments in the accompanying half-tone, is designed for a wide variety of work. It was originally made for the shop use of the makers, they needing such a tool, and finding none in the market to fill all the requirements. In addition to the operations usually performed on a hand lathe equipped with a slide rest, all of those of a turret lathe, and most of those of a screw machine may also be accomplished. The swing of the lathe is 12 inches and the hole in the spindle takes stock up to ⅝ inch. The steady rest carries an efficient cutting off device by which pieces may be cut from the stock when the various other operations are completed. This device is used with a Pratt & Whitney cutting-off tool. The lathe has a compound slide rest which registers always with the Vs, and which has a regular T slot for the tool-post. The slide rest may be converted into a very desirable turret slide, always registering in all directions, in less than one minute, so that the lathe is also a turret machine for light work, doing good work in a rapid manner and at low cost. The turret may be removed from the slide rest and a tool-post inserted instantly. The rest being compound, and the arc graduated in degrees, various tapers may be cut. The tool is valuable for chuck work as well as on rods, its weight and rigidity being adapted



A TURRET HAND LATHE.

to such work. Both tail stock and slide rest are provided with screw and lever feed. The turret, 5 inches diameter, has six ¾-inch holes; 1¾ or 1½ belt is used. The lathe, as shown, weighs 550 pounds. It is made by John T. Burr & Son, Brooklyn, N. Y.

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The Steam and Power Plant for a Great University.

The problem of providing, most satisfactorily and efficiently, light, heat, power and ventilation for the group of immense buildings now rising on Washington Heights, in this city, for the new home of Columbia University was one worthy of a great modern engineer, and the way in which it is being solved and carried out must be of interest to all our readers.

Although the buildings are individually very large, even as modern buildings go, and separated by considerable distances, it was considered better in many ways to establish a single central plant for the whole system, rather than separate installments for each building. As a consequence the power-house is as large as would be required for a great trolley or cable road or for a metropolitan electric-light station. The power-house, which is really the basement of an Alumni Memorial Hall and large academic theatre to be built later, is 160 feet long by 100 feet broad, with a ceiling 34 feet high, and is surrounded by a broad gallery 22 feet above the floor. The gallery, besides serving as a means of communication, will carry the various steam, water, air and gas pipes and electric conduits.

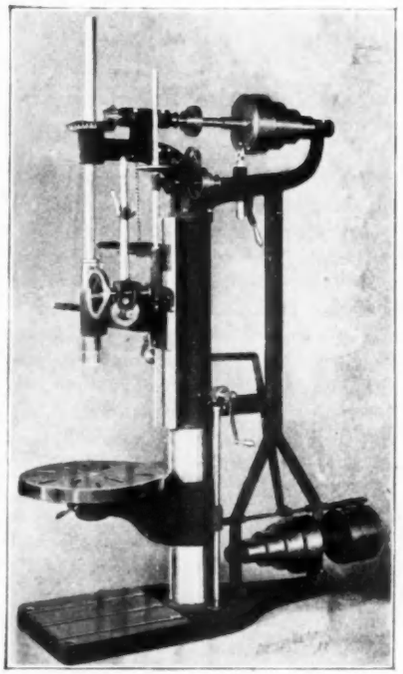
The boiler room will occupy two-thirds of the main floor, and will be separated from the engine and machinery room by an iron and glass screen to the hight of the gallery; a 20-ton traveling crane being thus able to traverse the whole length of the building. Nine Babcock & Wilcox boilers, aggregating 2,000 horse-power, have already been placed along one side of the boiler room, with space for as many more upon the other side. The working pressure will be 200 pounds. Below the working floor of the boilers are compartments for ash-pits, forced draught and smoke flues, running longitudinally through the room. Storage is provided for 4,000 tons of coal, and an elaborate system of tramways, with two-thirds of a mile of track, conveys both coal and ashes. All connections to the boilers from the air and blast flues are under the floor, and it is possible to walk completely around each boiler.

From the boilers the steam passes into a 16-inch main, which encircles the power-house, and branches for heating purposes lead off to the different buildings. Steam pipes to all the engines and pumps tap directly from this main, so that full boiler pressure will be assured. There will be two Allis engines, 300 horse-power each. These engines will be entirely self-contained, the outboard pillow blocks being connected to the engine frames by an extension of the bed-plates. The fly-wheels will be built up of steel plates, and will weigh 15 tons each. There will also be two Armington & Sims 100 horse-power engines. All these engines will be directly connected to Crocker & Wheeler multipolar generators, which will furnish not only the illumination for the building, but also power, where needed, throughout for elevators, fans, etc. Sixty tons of copper are to be used in the feeder mains alone. The electrical installation has been by Mr. C. O. Mailloux.

The power-house will contain a Rand duplex air compressor and Worthington pumps for various services, including a fire pump with a capacity of 1,000 gallons per minute. The entire plant will be handsomely and elaborately finished in every detail, and will be, as it should be, a model to be extensively followed in future public buildings. The arrangement of the power-house has been designed by Mr. E. A. Darling, superintendent of buildings and grounds. Many of the particulars given above are from an excellent descriptive article in the New York "Evening Post."

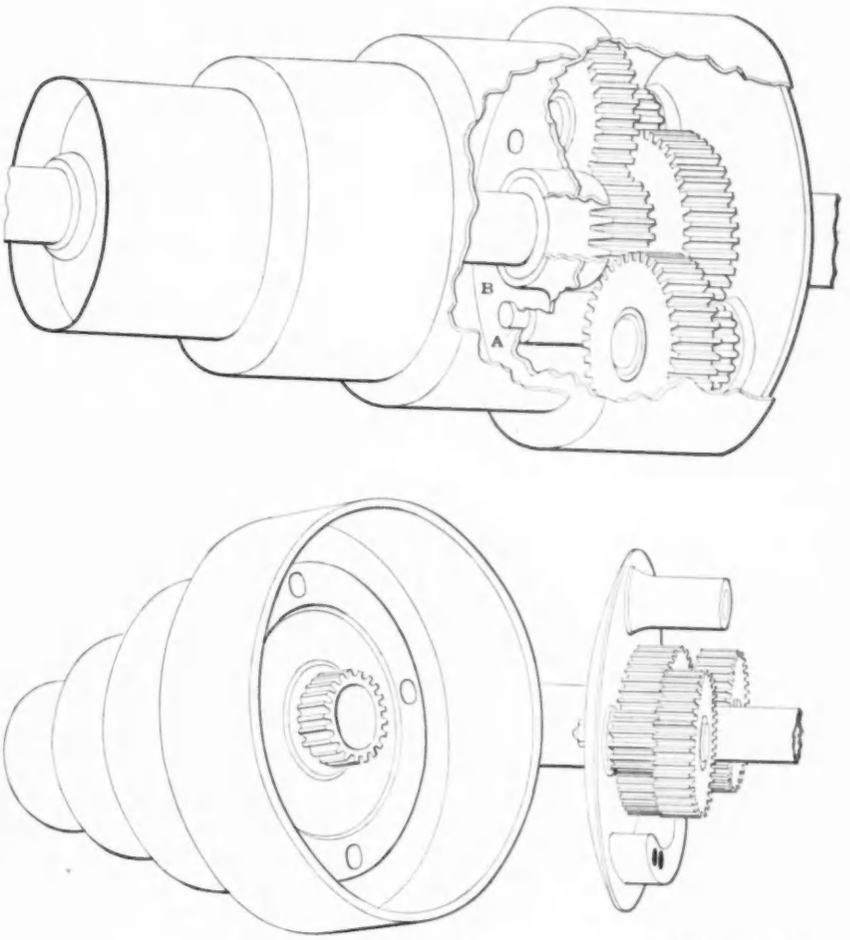
A New Upright Drill.

We illustrate a new upright drill which combines in itself an unusual number of important and valuable features, and which the half-tone brings out quite clearly. The drill shown is 26-inch swing, with sliding head for the spindle, giving a large vertical range of movement. The drill is back geared and balanced whether in or out of gear. The vertical plunger in front of the main cone has a bevel face, and when it is thrown up, by the operation of the hand lever below, it catches and pulls out the pin in the large gear-carrying plate, holding it from turning. When the plunger is drawn down, the pin is released and springs into one of the holes inside the cone, locking it and causing the entire system to revolve together. The back gear ratio is 5½ to 1. Fig. 2



A NEW UPRIGHT DRILL.

shows the cone cut away and the arrangement of the gearing. The spindle has power feed, hand feed (either by the hand wheel and worm or by the long vertical lever) and quick return. The hand latch on the vertical lever throws the worm in or out of gear. The long lever is held in the normal vertical position, when not in use for hand feeding, by means of a fork projecting from the sleeve of the vertical feed spindle. An automatic stop, not shown in the half-tone, is provided for the feed. This can be set for any depth of hole required. The weight of the spindle and head is counterbalanced by a weight in the column, and the balance of the spindle can be adjusted by sliding the chain along the horizontal lever to which it is attached. The table is raised and lowered by the stationary screw at the side. The plate turns and also swings either way out of the center, and clamps in any position. Countershafts are furnished with backing pulleys for tapping if required, and the drills are made either with all of the special features or with such of them as may be required. The hight of the drill is 7 feet; greatest distance of spindle from base, 53 inches; least distance, 21 inches; travel of sliding head, 21 inches; feed travel of spindle, 11 inches; face of pulleys, 3 inches; floor space, 21 x 52 inches; weight, 1,350. The drill is made by W. F. & John Barnes Company, Rockford, Ill.



DETAILS OF DRIVING GEAR.

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Calculations for Oil Engines.

BY W. H. BOOTH.

Certain experiences in the working of gas and oil engines have shown me that a good deal of uncertainty exists as to their requirements. This is especially so in regard to the use of water for cooling purposes, the amount of which is looked upon as so absolutely a matter of trial that no one can pretend to say what will be sufficient unless an actual trial be made. Yet there ought to be nothing very difficult in actually figuring the amounts. There are ample data to hand on which to base our calculations.

In the first place, we are told that the temperature of the cooling vessel should not exceed, say, 150 degrees. We will take that figure as a basis, and we will assume that there is no constant supply of water, but that the only water available is that necessary to keep up the waste due to evaporation. Let it be supposed that the engine is intended to run for ten hours at a time, and that every hour it will consume 1 pound of oil. This we can tell if we know the duty and take the makers' figures, which are, say, 1 pint of oil per hour per horse-power. As a pint of water weighs 1¼ pounds and the density or specific gravity of oil is about .800, the engine will burn just about 1 pound weight. In such calculations round numbers are sufficiently good to help us to fairly accurate conclusions. The calorific power of petroleum is about 21,000 heat units. Of this amount some is converted into work, a larger portion goes off in the exhaust, and probably a half goes into the water jacket. It is this half that alone concerns us if we are seeking to know the amount of cooling water necessary. In ten hours, therefore, the engine will put $(21{,}000 \div 2) \times 10$ heat units into the water jacket. This equals 105,000 heat units. We will now suppose that every day we are able to start with the cooling

vessel full of water at 70 degrees and that we must not raise the temperature above 150 degrees. We thus have a margin of 80 degrees. If now we divide the available heat units as found above, namely, 105,000, by the 80 degrees margin of temperature, we get the figure 1,310, and we know at once that the jacket heat of the engine will raise the temperature of 1,310 pounds of water to the limit of temperature. An engine of 1 horse-power requires, therefore, a cooling tank of 131 gallons capacity, or, say, 160 gallons American measure.

I have not by me any figures showing the rate of cooling of a vessel of hot water, but judging by the cooling down at night of the ordinary hot-water supply of the house, between the time when the fire is allowed to die out and the morning bath, it would seem not unreasonable to expect the cooling tank to come down by radiation to 70 degrees in the fourteen idle hours. In ten hours, if this assumption be correct, the cooling tank will lose ten-fourteenths of 80 degrees, or, say, 60 degrees. It will, in fact, during the period in which the engine is working, lose 60 degrees of temperature and gain from the engine 80 degrees. The difference is 20 degrees, and if the figures and data be correct, it would seem that during ten hours the temperature of 160 gallons of water will only be raised 20 degrees. The doubtful item in the data is the rate of cooling. I am told by a maker of oil engines that about 2,000 pounds of water will keep cool an engine of 6 brake horse-power.

Let us try and figure this roughly out. The jacket heat of 6 brake horse-power will be evidently about 630,000 thermal units. Divide this by 80, which, as before, we will take as the rise of temperature allowable, and the result is 8,000 pounds of water. But as we have seen that the water loses heat at the rate of 60 degrees and acquires it at the rate of 80 degrees, it will be evident that the amount required will be 6,000 pounds less than the above, or only 2,000 pounds. This coincides with the makers' figures. The uncertain figures in my calculations are, of course, those relating to the cooling rate of a hot-water tank. Experiments on tanks of several sizes are required to show the hourly loss of temperature of a tank full of hot water. Were these experiments made, and the results published, we should probably see in the future that the cooling tanks of oil and gas engines would be more frequently placed outside the wall of the engine room, so as to take advantage of the better rediation. Were these figures of cooling rates available, it would be a very simple matter to show for any case what capacity of tank was necessary. Much depends upon the length of continuous run. An engine run for 12 hours has only 12 hours for the cooling down of the tank, whereas an engine run for only 8 hours has 16 hours in which to cool down to initial temperature, so that shortening the working day has a double effect in enabling the cooling vessel to be reduced. My figures are of course very rough. Heating of the water is continuous and steady, because the source of heat is uniform; but the rate of cooling down is not to be expressed by a straight line. Radiation and loss of heat by air contact becomes more rapid as the temperature rises, and while the rise of temperature of the tank will be rapid at first, the rate of increase will diminish as the difference of temperature between the water and the atmosphere increases and radiation becomes more rapid. Especially must the rise of temperature become very slow as the boiling point is approached, for the cooling is then much assisted by the absorbtion of much heat in the latent form by the now escaping vapor. At 212 degrees there is, of course, no further possible increase, for all surplus heat not escaping as radiation goes off in the steam.

When we come seriously to think of it, the economic absurdity of a water jacket on the cylinder of an oil or gas engine is very obvious. The jacket absorbs about half the heat and about forty per cent. escapes in the exhaust, leaving ten per cent. for work. Could we abolish the jacket and lose no more by the exhaust, the efficiency would be increased 500 per cent. The only obstacle to this is the want of a suitable cylinder material, so that the cylinder could be worked at probably a red heat. Given the possibility of this, it would only be necessary to inject oil at a proper pressure at the right time to secure the above desirable result. If this result could be secured with oil, the gas engine would be left hopelessly behind until it also was arranged on similar lines. The practical difficulties in the way are very great, but probably are not insuperable. A very hot cylinder is not possible where the working fluid is introduced before compression, because explosion would be premature. It is necessary, therefore, that provision should be made to introduce and explode the working fluid simultaneously. But the real difficulty is, of course, the working of the cylinder and piston. The first natural solution is an extremely long back end to the piston in order to enable the working part of the piston to be placed far enough from the zone of great heat, but this involves bulk and weight and problems of inertia. We hear a good deal about the impossibility of running a high-speed steam engine, except single acting, with the thrust always upon the connecting rod. We all know that this is not true, and that the whole question is one of workmanship, for not only are many high-speed engines double acting, but the gas engine itself has not a connecting rod under constant thrust. For one out stroke it is so, when the explosion occurs; but during inlet of the fresh charge the crank is pulling the piston. The crank of a gas engine is thus a severely stressed member, exposed to full range of opposite stresses, and as a running machine, has worse duties than a steam engine. The problem of the internal-combustion engines is one of great interest. It is curious that, as a motor, conditions of temperature render it necessary to treat its cylinder in a manner exactly opposite to that in which the cylinder of a steam engine is treated. One we try to keep hot, the other we cool down at a great loss of economy; yet, in spite of this, the reduction in the number of processes enables the gas engine to show a good account. But I am wandering from my purpose, which was, to show how the amount of cooling water could be found beforehand, a knowledge of which may sometimes be useful to convince doubters, as recently it so proved useful to myself.

London.

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Stacking Armature Disks by Machine.

BY GEO. D. RICE.

Fig. 1 is a drawing of a new form of machine for stacking armature disks. It is operated by compressed air, and is not patented. This machine, and the one in Fig. 2, were designed by the writer for an electrical machine shop, in which the making up of armatures was formerly done by hand, as is the usual way in very many shops. Hand stacking not only is more costly, owing to the time consumed, but is likely to lack the uniformity of machine work. Where the disks are worked tediously down upon the shaft by hand, while the shaft is in a vise, there must necessarily be more or less irregularity. Both the machines shown in the drawings were made full-size working models, and are thoroughly practicable. The first one, of course, can be used only in shops where compressed air is available. Any mechanic can build it after securing the cylinder *E* from some firm dealing in such goods. This cylinder should be adjusted to a strong wooden frame and the valve provided with a long handle *F*, so that the operator can work it readily. The armature *A* is placed upright in a chuck as shown, this chuck being set screwed to the base piece, which may be either wood or iron. The hollow plunger contrivance *C* is shown in section, and is cast iron.

This plunger is attached to the piston of the air cylinder, and is caused to rise after each depression by the spiral steel springs *D D*. A pile of each kind of disks is placed at either side on the base, and one is adjusted over the armature when the plunger is up. It simply remains to open the air-cock and let the plunger descend upon the disk as at *B*, and the latter will be promptly and firmly pressed down into position. As soon as the disk is set the valve is closed, and the springs lift the

plunger and the operation is repeated. Fig. 2 is another style of device for same work. The armature is indicated at *A*, the disk about to be pressed down is marked *B*, and the pressing form, which is a steel circular piece fixed to the cross pieces *D D*, is signified *C*. This portion of the machine is stationary, and the disk is pressed to position by elevating the carriage *E*. This is done with a rod *F*

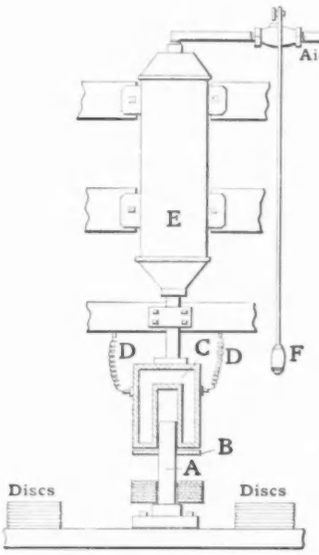

Fig. 1

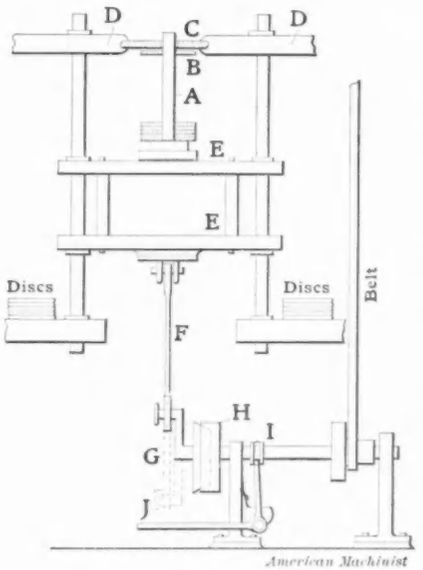

Fig. 2

ARMATURE STACKING MACHINE.

and crank *G*, the latter being driven by the shaft through the friction pulley *H*. The inside pulley is leather covered, and the workman presses the lever *J* with his foot, causing the other end of the lever to act on the collar at *I* and bite the pulleys. A spring fixed beneath the foot end lifts the same and releases the bite as soon as the foot is removed, which is done as soon as the disk is set. The part of the pulley to which the collar is attached is keyed to the shaft, while that part which is leather covered is connected with the crank *G*. The key in the former must have enough play to permit of the pulley being shifted easily in either direction on the shaft.

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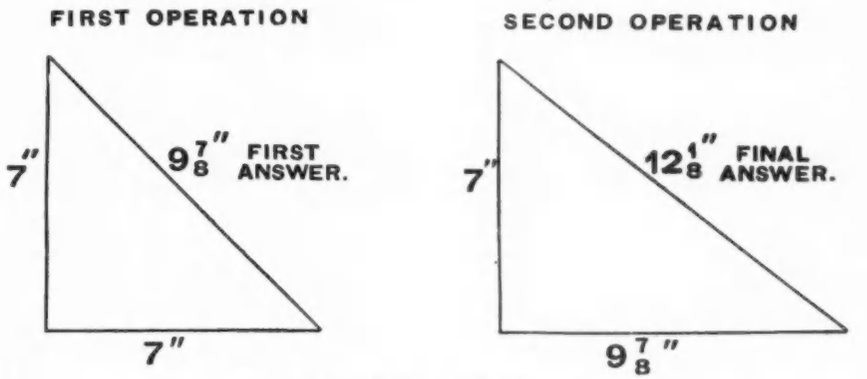
Letters from Practical Men.

The Equation of Pipes.

Editor American Machinist:

Referring to my article in your paper of March 25th, I have received the following inquiries, the answers to which may be of interest to your readers:

Wm. McDowell, of Garrett, Pa., asks: How can I ascertain the diameter of a pipe which will carry the contents of three 7-inch pipes, and W. H. Millan, asks, how can I find the diameter of a pipe to carry the contents of a 5-inch, 6-inch and 7-inch pipe, according to the method given in yours of March 26th. A.—Let us first determine the contents of two of these pipes and add that and the third.



THE EQUATION OF PIPES.

This method requiries two operations as shown in the accompanying sketches. First lay off 7 inches on each leg of a right-angle triangle and measure the hypothenuse which will be found to be 9⅞ inches. This is the diameter of a pipe equal in capacity to two 7-inch pipes. With this as one side of a triangle and the remaining 7-inch pipe as the second side we find the hypothenuse to be 12⅛ inches, which is the diameter of a pipe equal to three 7-inch pipes, which is the answer required.

The second question may be solved in exactly the same way. First by ascertaining the pipe equal to a 5-inch and a 6-inch together, then as in the second operation, adding the capacity of a 7-inch pipe.

W. H. SARGENT.

St. Johnsbury, Vt.

[Mr. Sargent's method gives the diameter of a large pipe having a cross section equal to several smaller pipes, but the carrying capacities of the pipes are not strictly in proportion to their areas. To suppose them to be so would make the capacity vary as the squares of their diameters, whereas, in fact, the capacity is as the square root of the fifth power of the diameter—it being supposed that the pipe is so long as to reduce the entry head to a negligible factor—this length being usually assumed to be one thousand diameters. See an article by Mr. E. Sherman Gould, on the "Flow of Water in Pipes" in our issue of November 12th last. Mr. Sargent's method is probably sufficiently accurate for most ordinary cases, especially where the pipes are short, and it is certainly much better than the usual guess work.—Ed.]

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Sizes of Standard Catalogs.

Editor American Machinist:

I have frequently read the note in your columns about the sizes of standard catalogs. I, of course, appreciate the desirability of having a standard or uniform size, so that if such things are to be preserved they will pile up neatly or fit into bins or pigeon-holes without waste of room. It is common-sensible, for the same reason, to have the smaller sizes successively one-half of the next larger size, so that when the stock of big ones is all stowed away, the smaller ones will pile neatly in twos on top of them. In view of this, I cannot see why the smallest size is what it is. It is pretty certain that 3½ x 6 inches is not half of 6 x 9 inches. There is another point, perhaps not as important, but which still is worth thinking of, and that is that it would be rather better if the same shape of rectangle was obtained for each size. 9 x 12 is nearer a square in shape than 9 x 6 is, and 6 x 3½ is longer in proportion to width than either of the others. I notice by the erratic sizes given for the catalogs which you notice that the standard sizes are not being adopted as generally as would seem to be desirable. Is it not possible that the unsatisfactoriness or the inconsistencies of the standards are recognized, and that consequently they are rejected? Mr. Editor, can you tell us why things are just as they are? T. R. L.

[We cannot satisfactorily explain the

matter. The 6 x 9 standard size has been quite widely adopted, especially by the societies, for their transactions. The larger size—the size of our sheet—seems to be also quite satisfactory for its appropriate uses, and the smaller size does not seem to be objectionable, except for its eccentric relation to the other two.

It is quite likely that it would have been better if, in the beginning, the matter had been approached in a little more methodical way. Thus, when the longest dimension of the largest size was determined upon, it would then have been easy to have made the other dimension such that each successive halving would have produced approximately the same shape as the original. The shape so determined would not only have been the most useful, but would also probably have been the best-looking shape. If the length of the long side had been, as now, 12 inches, then the proportion for the short side would have been:

$$12 : x :: x : \frac{12}{2}$$

then $x^2 = \frac{144}{2}$ and $x = \sqrt{72} = 8.438$ for the shorter side. This is almost exactly $8\frac{7}{16}$, and if $8\frac{1}{2}$ had been adopted instead of 9 inches, for the shorter side, giving us a consistent series like this: 12 x 8½, 8½ x 6, 6 x 4¼ and 4¼ x 3, it is difficult to see why it would not have been more satisfactory.

We, however, do not wish to be placed in the attitude of seeming to advocate a change. The present standard sizes are really tolerably satisfactory, and those who adopt them do not usually see any reason for thereafter departing from them. We have honestly and earnestly advocated the present standard sizes, and expect to continue to do so.]

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One Thing the Average Molder Don't Know.

Editor of the American Machinist:

I was not much surprised that to the late article of July 8th on "What the Average Molder Don't Know," you attached the editorial exclamation "What does the average molder know?"

That list may look rash, harsh, to many readers, but they are the conclusions formed after long and careful observations. To estabish the truthfulness of one of the items, namely, "the average molder don't know what size to cut the gates in pipes, steam chests, etc.," I have the up to date proof, and it is an interesting specimen brick, occurring less than a year ago.

A foundry firm in a first-class western city had a contract to furnish about fifty, 8-inch flanged pipes, ⅞ inch thick. On account of limited core oven capacity, that firm sublet the job to the largest firm in town, who delivered them rapidly.

The writer had the opportunity of examining those pipes, as delivered, and found that at least three-fourths of the pouring gates left a shrink blemish reaching nearly through the casting, although the specifications called for sound castings.

The painter's putty covered a multitude, etc.

They were for conveying gas in a new paper making process, under the heavy pressure of a pump. Let us see who is responsible for this extensive failure. We have, at least, two molders who cast them, first and second foreman and two proprietors, both old practical molders, one giving a constant oversight of the work, that is, six successful molders who had a deep interest, but unable to correct those errors. Does the average molder know how to shape his gates on pipes, etc.

R. D. MOORE.

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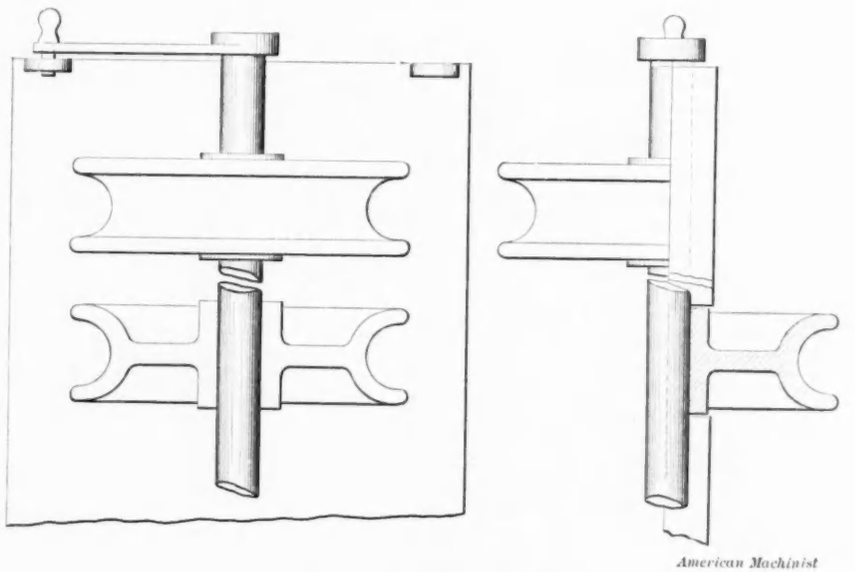
Molding Small Sheaves.

Editor American Machinist:

I send you herewith sketch of another way to mold small sheaves, without a cheek and third parting. The patterns are made in halves, parting transversely, and as many as will go into the flask are fastened onto an arbor just the size of the core wanted in the hub. The arbor makes the print for core. We use a crank or lever on the end of the arbor, with a pin or a notch in the end of the plate to fasten it either way up. The flask and board are made with one pin and one eye on cope and drag, so we ram both cope and nowel part of mold on same board, thus only needing half the patterns it would otherwise require.



MOLDING ROPE SHEAVES.

The sketch shows one sheave up, ready for ramming up the flask, and one turned out or down, ready to lift off flask. It will be seen that the parting board acts as a stripping plate as well, and the patterns being drawn through the sand, makes a very smooth mold.

I have used this plan where we made from 20,000 to 30,000 sheaves each season, and I know that it works well.

EZRA ESTEP.

Sandwich, Ill.

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"Pit" Coal as Fuel for Steel Workers.

Editor American Machinist:

The advantage which charcoal has over fossil coal as a fuel for working steel lies in the fact that the charcoal is perfectly free from sulphur, while the pit coal is very seldom found free from that objectionable element. The general treatment of steel with either of these fuels is the same, and, aside from the element of sulphur in the coal, the same precautions are necessary in each case. The first thing to be done with a coal carrying much sulphur, if such a coal must be used, is to clear the fire of all slag and clinker, and then coke the coal at a high temperature, and with a good blast, in

order to burn out as much of the su'phur as possible. The fire should be made deep and large, care being taken to thoroughly coke all green coal, to distribute the blast as much as possible and to break up all jets. The steel should be heated with very moderate blast, and beneath the surface of the fire. The object of the moderate blast and large fire is that there may be no excess of oxygen to decarburize the steel by combining with the carbon, but rather an excess of carbon, which will act on the steel in the same manner as the charcoal acts during the process of converting wrought iron into steel in the cementation furnace. Steel can be just as easily spoiled in a charcoal fire as in one of pit coal, and it is usually spoiled in both either by overheating or by heating too rapidly with a strong blast. When overheated, the carbon is reduced by combining with the oxide of iron formed by rapid combination of the iron with the oxygen of the air. When heated rapidly with blast, even if heated to the lowest workable temperature, there is an excess of oxygen present in the blast, which has a powerful decarburizing effect, exactly similar to that made use of in producing wrought iron in the bloomery.

To get the best results with steel, whether worked in a coal or a charcoal fire, the essential points are to regulate the blast and the size and depth of fire, so that all the oxygen supplied by the b'ast combines with the carbon before coming in contact with the steel, and to carry the heating no further than is necessary for properly working the particular steel used.

GEORGE RAE.

New York City.

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The Homeopathic Reamer Grinder.

Editor American Machinist:

Referring to Mr. Frank Richards' letter on "A Homeopathic Reamer Grinder Wanted," in issue of the "American Machinist" of July 15th, his conclusions, reached after a careful consideration of the causes which result in chatters in reamed holes, are certainly sound. We are only surprised that he is not familiar with the method by which the reamers made by the Pratt & Whitney Company are ground, which overcomes this tendency to chatter, and which practically includes the process of grinding which he recommends.

We would refer Mr. Richards to Patent No. 308669, which covers completely the case in point. This patent was issued December 2, 1884, to John W. Heyer, Hartford, Conn., for an oscillating fixture for relieving the teeth of reamers, and has been in use by the Pratt & Whitney Company since that date. We call this matter to his attention to show him that this method has long been considered practical, and has been adopted and carried out. When used as a reamer should be used, it certainly does produce a hole which is free from chatter marks. It is specially applicable to taper reamers of whatever angle or taper.

The oscillating motion given to the fixture cannot, however, be described as a "wabble," as the movement of the reamer before the wheel is a result of an oscillation on centers which are slightly eccentric relative to the centers of the reamer itself, bringing the heel of the tooth nearer the wheel in the movement, and thus making the line of the edge the highest along the whole length of the flute. Each tooth being indexed for this condition makes every point along the edges of the teeth concentric, and thus insures free and equal cutting for all the teeth of the reamer. Another important feature is evidently that for tool-makers' use, this clearance can be reduced to a very small amount, and thus the size of the reamer maintained much longer than by the ordinary method of relieving the teeth.

In short the suggestion brought out by Mr. Richards is fully covered by the specifications of this patent, and we think, if he will refer to the claims and the drawing in connection with the latter, he will find that this method has been successfully developed. As a matter of fact, it has been used for the clearance of the teeth of all the reamers made by this company since 1884.

THE PRATT & WHITNEY CO.

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The Cutter and Reamer Grinder.

Editor American Machinist:

According to the views of some of your correspondents, the old method of backing off the teeth of reamers with a file knocks the modern method of grinding into a cocked hat. It is a fact that reamers are ground on a universal grinder and the clearance ground on a cutter and reamer grinding machine, and there is no tendency on the part of the reamer to chatter; in fact, it follows its natural inclination, unless forced by the man who operates it to go wrong. The main point is to insure the teeth being all of the same hight in the universal grinding machine; then as little or great a clearance may be given the teeth in the cutter and reamer grinder as the nature of the work may require.

I cannot allow the libel on the cutter and reamer grinder to go unchallenged, for the reason that this machine is doing satisfactory work when handled intelligently. With an emery wheel six or seven inches in diameter, the concave surface on the top of the tooth will be so slight near the cutting edge as to cut no figure, and by grinding not quite to an edge, a few rubs with an oil stone or fine emery rub stone will put the teeth in better shape for good work than any antiquated hand method could possibly do.

I made and used reamers before the advent of the grinding machine, but my later experience has served to make me loth to go back to the old methods, and I feel that all practical tool-makers will indorse this statement.

The cause of chattering seems to be thoroughly understood by your correspondents, but the methods proposed for curing the evil are misleading, because from them the uninitiated might get the idea that the designers of the grinding machines for reamers had no conception of what was required of them, in spite of the fact that these machines are in successful operation in a large number of shops, from which there is no complaint of chattering reamers. Yours truly,

D. D. DONOVAN.

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Meliorists Wanted.

The editor of the Boston "Watchman" is neither an optimist nor a pessimist. "He is a meliorist. He believes in looking at things exactly as they are and trying to make them better." Let us have more meliorists.

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An exaggerated toy for the children of larger growth, or a mechanical or engineering monstrosity, seems to be an inevitable feature of the later expositions. At Paris it was the Eiffel Tower, at Chicago the Ferris Wheel; at Nashville it is a gigantic see-saw, and now at Omaha still another novelty is proposed and in fair way of accomplishment. It is to consist of a tower with a spreading head like an umbrella, which is to revolve, carrying a number of cars suspended at its periphery. The vertical standard is to be 350 feet high and the diameter of the arms 220 feet. Passengers will be given a ten-minute whirl.

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The Monocacy Blasting Company are using, near Reading, Pa., dynamite for breaking up cannon and other heavy castings for scrap. A recent consignment to them consisted of two solid cast-iron guns, weighing about 48 tons each, which were used at the siege of Vicksburg.

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The tail of the whale is horizontal, while those of true fishes are vertical. The whale has business at the surface quite frequently, and the horizontal tail must be a great convenience in rising and descending again.

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In New York city there are not less than 5,000 passenger elevators in use, and in business hours it is asserted that more persons are carried vertically than horizontally. The elevator service is free.

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Blocks of railroad stocks are not good foundation stones for educational institutions. We are, of course, all sorry to hear of the troubles and the gloomy prospects of Johns Hopkins and Lehigh.

AMERICAN MACHINIST

Published Thursdays by

American Machinist Publishing Co.,
256 Broadway, New York.

John A. Hill, President and Treasurer.
C. A. Hansmann, Sec'y.

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Editoral Department.
Fred J. Miller, Chief.
Frank Richards,
F. A. Halsey,
Edward P. Buffet, } Associate Editors.

▲ ▲ ▲

Illustration Department.
A. L. Donnell, Chief.

▲ ▲ ▲

Advertising Department.
C. P. Day, Eastern Representative.
J. M. Wakeman, Western Representative.

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English Representative.
R. E. Howard, 9 Leonard St., Finsbury, London, E. C.

▲ ▲ ▲

Space in advertising pages only is for sale.

We invite correspondence on subjects pertaining to machinery.

Name and address must always be given, though not necessarily published.

Communications for or relating to the reading columns should be addressed to the Editor. All business communications should be addressed to the Company.

Subscribers can have their mailing address changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.

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Entered at Post Office, New York, as second-class mail matter.

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In Defense of the Average.

Certain words sometimes get to be too handy, and then they are pretty sure to be used not only too frequently, but more or less incorrectly, and too often injustice is done. We read everywhere about the average man, and in the technical press about the average workman, the average molder, the average machinist, and all the rest. Now, it is a rather singular fact that this use of the word "average" is almost invariably coupled with something derogatory or more or less uncomplimentary. The average machinist doesn't know, the average machinist doesn't care, the average machinist is constantly doing this, that or the other thing that he should not. It seems to be perfectly safe to say—and so we say it—of the average machinist, what we would never think of saying of or to any individual machinist within the range of our acquaintance.

Only recently a respected contributor told us about what the average molder doesn't know, and we might easily have gathered from his remarks that many of the things most important for the molder to know are not known to the average molder. There can be little doubt that our contributor had some truth to back him. It was probably true that of the items of foundry knowledge enumerated by him, each of them is unknown to some molder, or so-called molder, that may somewhere be found. And herein we have a hint as to wherein the misuse of the average consists. The average is generally assumed to be representative or typical of the whole. It must in common justice fairly—or at least not unfairly—represent a majority of the whole. Those who have no other means of judging of the assertions made will almost invariably accept the average as representing the entire body. There is manifest injustice, then, in applying statements of fact to the average which are only true of the minority, or of the exceptional individuals of the class spoken of. There are many things that the average molder doesn't know; but there was never a day before to-day when the average molder knew so much of what it is practically necessary for the molder to know, as is sufficiently evidenced by the molder's output, and there is no reason to look out with discouragement upon the molder's future.

The average machinist, of whom we are permitted specially to speak, is only to be mentioned with respect and appreciation. He is first of all a good fellow, as we know by lifelong experience. He is appreciative of skill and achievement everywhere. He is free with his knowledge, ready to tell anything that he knows, and distinctly helpful, especially with his shopmates. He is always glad to be associated with a paying and prosperous business rather than with a struggling and unfortunate one. He is industrious and faithful, and turns out a pile of good work. There are those in the trade of whom none of this may be said. There may be those who are bad all the way through, but not one of these is ever to be spoken of as the average machinist.

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Every Man an Inventor.

The verb to invent comes to us from the Latin, and etymologically it precisely represents the act for which in our language it stands. To invent is to come upon or to find. Spenser says: "Or Bacchus' merry fruit they did *invent*," meaning merely that some grapes were found. Bacon says: "To *invent* is to discover that we know not."

We are too commonly in the habit of thinking and speaking of invention as something different from discovery, different in the thing accomplished, and different also in the faculty or constitution of mind by which it is accomplished. The inventive mind is often spoken of as the creative mind, and the inventor is honored as the producer of something previously non-existent. This is not only incorrect, but it is wofully misleading. It represents the inventive faculty as a more or less peculiar one, and the successful inventor is held to be, in some of the details of his mental mechanism, differently constituted from the common herd. There is nothing but fallacy in the idea. Mechanical invention is never creation, and has none of the essential characteristics of creation. It, at the best, and in its most fruitful operation, discovers and adopts, or avails itself of, existing possibilities. The possibilities have existed from the foundation of the world for all that we know. Each different or better way of doing a thing has always been possible; so that when the latest, and, up to date, the best known way is brought to light, it is merely the discovery or the recognition of the pre-existent possibility.

It is of great practical importance that correct views upon this subject should prevail, and it is a misfortune that the erroneous one is so prevalent. There is no distinct and separate inventive faculty for a gifted and favored few. Every man is a possible inventor, if not an actual one, and we differ, after all, in degrees of similar abilities, or in the extent of their profitable exercise.

While it is true enough that every man of sound mind is a possible inventor, it is still true that he who stays at home will never find the unknown islands in the yet untraveled seas. It is the pushing navigator who is the great discoverer. He who has already sailed the farthest is the one to see still farther than any other. As a starting qualification for a successful inventor, it is essential, and has always been essential, to know as much as possible of what already has been done in the same direction. When the highest and most advanced point of outlook has been reached, the keen eye, or, if you will, the alert mind and the darting imagination, may then count for much. Watt made his revolutionary improvements of the steam engine with the model of the best up-to-date engine before him. The boy telegraph operator has become the supreme inventor of the hour in electrical lines. Edison's transcendant "inventive genius" has not made him an improver of the steam engine, and Watt could not devise a long-distance telephone, and both because they had not the necessary advanced standpoint from which to set out on their discoveries. Invention is progressive. One thing leads to another and makes the way for another; makes its successor not only possible, but eventually inevitable. In the nature of things, the modern bicycle was perfectly possible thousands of years ago, and yet only within a decade has progressive invention had it within reach. So the Klondyke

gold has waited thousands of years for human hands to reach it.

It cannot be too much insisted upon, that the would-be inventor needs, first of all, and more than all else, knowledge. He should know what has been done, what is being done, and what means and facilities now exist for the doing. He should often, also, know of the failures in the line chosen, and the reasons for the failures, that he may not waste his time wandering in the wilderness. The existence of the inventive faculty is not to be assumed in advance, and no reliance is to be placed upon it until after the achievement. Whether it exist or not is scarcely worth debating. Knowledge only successively unlocks the gates of mechanical discovery.

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(118) H. C., Cincinnati, O., writes: Please let me know if it would be possible to expand gasolene in a boiler to run an engine the same as water is used. My idea is, to run a small engine this way for about two or three hours at a time, and then refill the boiler when it is cool. A.—It would be entirely possible to use gasolene in this manner, but water is much better and much safer.

(119) M. M., Evanstown, Wyo., writes: We have a special traction engine which does not develop sufficient power. There are two vertical cylinders 6 x 9 inches with a 37-tooth gear on engine shaft meshing into an idler gear, and this into a 50-tooth gear on an intermediate shaft. Then a 16-tooth pinion on this shaft drives a large internal gear of 120 teeth fastened to the driving wheel. The machine weighs 16,000 pounds. The engines run at 190 revolutions, and the machine will not much more than move itself; but it is intended to develop at least 10 horsepower besides. There is not an engineer whom I can consult within 500 miles. I can alter the present position of the gear shafts in case a change should be considered necessary. Any information or suggestions would be gratefully received. A.—We are not informed as to the diameter of the drivers nor of the kind of road the machine is to run on. We have some data from Aveling & Porter traction engines which run upon good roads, and in one of those we find the revolutions of the engine shaft to be 17 to 1 of the traction wheel. In our correspondent's machine the ratio is $(120 \times 50) \div (37 \times 16) = 10.13$. Probably, if the pinion on the engine shaft were changed to 24 teeth, and a 60-tooth gear in place of the 50, making the ratio 18.75, it would be found to be a decided improvement.

(120) C. E. G., Mass., asks for a formula for the thickness of cast-iron plates subjected to steam pressure, such as hand-hole plates, steam-chest covers, etc. A.—We know of no rational formula for this purpose which is entitled to confidence. The so-called rational formulas are notoriously absurd in their results, calling for thicknesses two or three times what are actually necessary and used. The strength of flat plates is a subject which has received less investigation than probably any other of equal importance connected with the strength of materials, and such few experiments as have been made have been on boiler plates, and not on cast iron. Nicholl's rule for finding the bursting strength of flat unstayed surfaces is: Multiply the thickness of the plate in inches by ten times the tensile strength of the material used, and divide the product by the area of the head in inches. This rule agrees well with experiments made by Mr. Nicholls on boiler plate, which, however, were restricted in their range. The rule of the United States Board of Supervising Inspectors of Steam Vessels for flat unstayed flanged heads of steam drums or boiler shells is as follows: The thickness of plate in inches multiplied by one-sixth of its tensile strength in pounds, which product divided by the area of the head in square inches multiplied by .09 will give pressure per square inch allowed. Seaton first finds the thickness of the cylinder barrel by this formula:

$$\text{Thickness} = \frac{\text{diameter}}{6000}(\text{gage pressure} + 50) + .2$$

and then takes as a constant the resulting thickness plus ¼ inch. The steam-chest covers are then made .7 of this constant. In our own work we have usually made the thickness of steam-chest covers slightly in excess of that of the cylinder—the cover being curved for all above medium sizes. There is no doubt real need of experiments on this subject, and it would seem that ample facilities for these exist at the numerous laboratories of our engineering schools.

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Obituary.

Mr. Fred. B. Robb, secretary and treasurer of the Robb Engineering Company, Limited, of Amherst, N. S., was drowned while bathing at Fox Harbor, N. S., July 20th.

John P. Lovell, head of the John P. Lovell Arms Company, of Boston, died at his summer home, Cottage City, Mass., on July 29th. Mr. Lovell was 70 years of age. He was a practical gunsmith, having learned his trade with A. B. Fairbanks, of Boston. The company of which he was the founder and head, is one of the largest of its kind in the United States.

Richard Garsed, a machine-shop graduate and a prominent Philadelphia manufacturer, died at Frankford, Pa., on July 27th, aged 78. He was born in Yorkshire, England, and came to this country with his parents when a small child. In 1830 the elder Garsed began the manufacture of power looms, and the son became his assistant when still very young. Richard became an expert mechanic, and invented several successful appliances. Before he was 21 years old he had increased the speed of power looms from 80 to 140 picks per minute. Later he became a prosperous mill proprietor. He was one of the first to advocate street railways, and secured their introduction in Philadelphia. He is said to have been the inventor of the "flat" rail for street service.

Personal.

Chief Engineer S. L. P. Ayres, United States Navy, Acting President of Naval Examining Board, having reached the age limit, was retired from active service on July 29th. Captain Ayres was born at Stamford, Conn., and was educated as a civil engineer. He became a Chief Engineer in 1870, with the rank of Lieutenant Commander, and received the rank of Captain in 1895. In 1891 he was Chief Engineer of the cruiser Brooklyn.

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Commercial Review.

NEW YORK, Saturday Evening, July 31.

WOOD-WORKING MACHINERY.

Now that the tariff has been put under lock and key, to remain so for the next four years, the Republican newspapers are telling us what a nice thing business is getting to be and the Democratic ones take as much pains to bring out the fact that people are still down in the mouth. One would hardly turn to wood-working machinery with the expectation of finding the views of the former authorities corroborated. It has long proved itself a dull subject, and this is a dull season of the year for it. Yet the status of wood-working machinery is not in all points so low as one might judge from the opinions of some of its votaries in this market. We have heard that certain of the factories, the S. A. Woods Company, of Boston, and the Atlantic Works, are running full force, full time, and this is probably true of others. The Berlin Machine Works report that the past month has been their best July since 1892, although naturally quiet on account of the season. We have requested the views of several companies by letter, and the two replies given below have been received; both of which look at the situation from its cheerful side.

Rowley & Hermance Company, Williamsport, Pa., write us: "The trade for the last year in wood-working machinery has not been all that could be desired, but we are pleased to say that we note a decided increase both in orders and in inquiries from nearly all parts of this country during the past month. Our friends throughout the country seem to have been awaiting for something to turn up. Some of them have told us that they would not make any additions or improvements in the way of labor-saving appliances until the tariff matter was settled. We have received more orders within the last ten days than for the preceding six weeks. The tone of the letters received now is very encouraging for future trade. We predict that within twelve months the factories of the country will have all the work that they can attend to. In regard to foreign trade, it is constantly improving. One-third of all the business that we did last month was for export. We are constantly shipping to England, Prussia, South Africa, South

America, Central America and Australia. We received a large order on Saturday for several of our late improved wood-working machines from Central America."

J. A. Fay & Co., Cincinnati, O., also take a sanguine view of the business prospects: "We are very hopeful as to the business outlook. The indications from our correspondence department lead us to believe that there will be a gradual improvement in our business, and that in the early part of next year we will see it back to the old basis. We have not looked for an immediate return to prosperity by the change of administration or the change in certain laws. A complete revolution from adversity to prosperity never reaches a community on such short notice. The conditions have led us to believe that we could not reasonably expect a return to good times before next year. Our export business has been very large in the past year, and the outlook for a much larger volume of business this year is very good in that department. As far as wood-working machinery is concerned, we believe our foreign neighbors are daily becoming more and more favorable to American tools; and as they become better known, the exportation of American wood-working machinery will increase to the extent that we will practically control the business."

The combination of wood-working machinery manufacturers has not yet been accomplished, but it is progressing, and apparently with prospects of success. The promoters talk sanguinely. Some of the manufacturers who have given options upon their stock are less confident. There will probably be snags in the way of its success, such as the necessity of some stock watering to pay for the promotion, and the difficulty of making the component parts of the organization live up to their price professions. Yet we are informed that the project is being vigorously pushed along toward conclusion and it is said that the plants are being appraised. Perhaps, however, the best solution will be, that the coming revival of business will render it unnecessary and the whole subject drop out of people's minds, because they have too much else to think about.

THE EXPORT FIELD.

Some good reports are heard of export trade in wood-working machinery. The Berlin Machine Works have recently sent some heavy machinery, etc., amounting to about $7,000, to Johannesburg, and a consignment to Melbourne, Australia. An important German inquiry is now in the field. Woodward & O'Conner, agents for L. Power & Co., and the Atlantic Works, report an improving trade with Mexico and South America, with good inquiries now on foot. A Western company has sold for European account a

(*Continued on page 35.*)

Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct

Mch. shop equipments. York & Co., Cleveland, O.

Engine Castings ⅛ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Gear and milling cutters, adjust. reamers, counterbars and tools, vert. millers, drill pr., cutter and surf. grind., shears. R. M. Clough, New Haven, Ct.

Cost of Manufacturing—Experienced manager will establish system of costs, giving exact account of every detail. Charge based on saving effected. Correspondence solicited. Geo. C. Thomas, 99 Nassau Street, New York, Room 212.

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Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday Morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Prac. toolmkr. & dftmen. wants wk. 124, AM. MACH.

Exp mch. draftsman. Box 100, AM. MACHINIST.

Wanted—Change by reliable all-round mech.; 28, 12 yrs. exp., ptns., mdls. and expmtl. 123, AM. MACH.

Mech. eng'r, with experience at designing tools, special machinery, etc. Box 119, AMER. MACHINIST.

Wanted—Sit., by machinist; experience enough to be foreman and is competent. Box 118, AM. MACH.

Experienced all-round mech. draftsman desires position; moderate salary. Box 121, AMER. MACH.

Mech. draftsman, with varied exp., wants pos., country no objctn.; refs., mod. terms. 122, AM. MACH.

A mech. eng., grad., with 18 months' exp., desires position; salary moderate. Box 117, AM. MACHINIST.

By exp. machinist, toolmaker; comp. and reliable; handled help 11 years; hard work'r. Box 89, AM. MACH.

Change wanted by a successf'l gen. foreman; have held pos with leading firms on Corliss eng., refrig. mach'y and air compressors Ad. Box 116, AM. MACH.

Exp. and successful shop manager wishes to make a change; superintendent or foreman position desired; best of references. Box 316, Providence, R. I.

Wanted—Situation by experienced man; has held pos. as toolmaker, foreman and assistant supt.; up on modern methods; ref. Box 120, AM. MACHINIST.

A first-class mchy. and jobbing mldr. out of work would take job on floor; capable of taking charge; good refs.; age 36; strictly temperate. 126, AM. MACH.

Foundry foreman open to engagement; engine, mach., locomotive or architectural work; green and dry sand or loam; iron, brass or semi-steel. For particulars and ref. address Box 113, AM. MACHINIST.

Help Wanted.

Wanted—First-class machinists. Charter Gas Engine Co., Stirling, Ills.

Wanted by a technological school a draftsman and a machinist; salaries $600 for forty-six weeks. State experience and give references. Address Box 97, AMERICAN MACHINIST.

Wanted—Man experienced in general steam engineering, especially in the operation of electric power and lighting apparatus, and refrigerating mchy., for chief engr. of packing house. Address in own handwriting, giving age, exp., sal. expected and refs., H. C. G., Room 46, 240 La Salle St., Chicago.

Wanted, by German tool works of high reputation, foreman for erecting shop; must be competent to introduce American system of building machines in quantities and interchangeable parts. A1 machine hand, for circular grinding in all its branches. A1 lathe hand competent to take charge of departm'nt; must be able to turn work cheaply and quickly. Those speaking German preferred. Address, stating salary, references, etc., Box 99, AM. MACHINIST.

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Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d h'd lathes & planers. S. M. York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Patents, Machinery Designed, Drawings. Henry F. Noyes, 56 Liberty Street, New York.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern, cheap and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

English agent, with extensive connection among buyers of Amer. mchy., wishes to solely represent a first-class firm Am. mch. tool makers. "Tools," care Parkinson, 20 Sackville St., Manchester, Eng.

Wanted Capital, $10,000—A one-half interest in an established machine tool company is offered a practical man having the executive ability to conduct the business. Strictly modern shop and equipment with ample orders. Address Box 49, AMERICAN MACHINIST.

A machine shop, with modern equipment, heavy and light machinery, cranes of 20 tons capacity and 10,000 square feet of unoccupied floor space, would contract to manufacture any kind of machinery. Parties already having machinery built under contract might do well to write us for estimates. Box 62, AMERICAN MACHINIST.

Wanted—In New York, an associate in the business of selling mch. tools, with $5,000 to $10,000, preferably a young man; must be an up-to-date mech. thoroughly conversant with modern mch. shop practice and not afraid of work. A good opportunity for the right man. Correspondence on the subject treated with the utmost confidence. Box 125, AMERICAN MACHINIST.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treasurer.

BENCH MILLING MACHINES

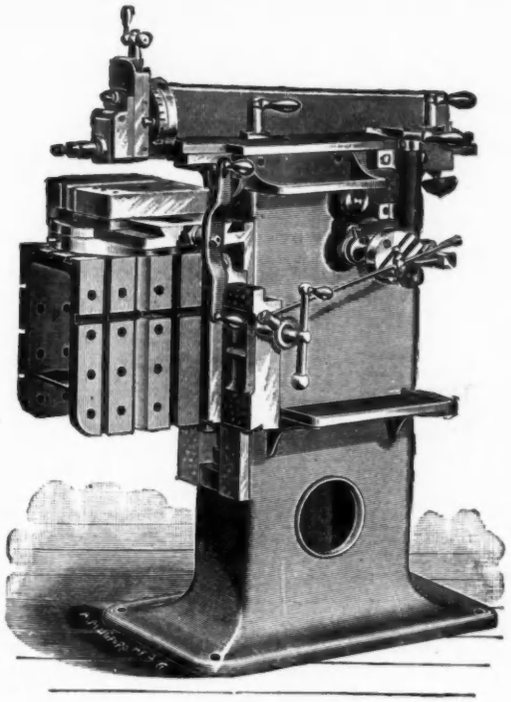
Are often wanted and are as useful as large ones in shops where the work is small. The Van Norman "Duplex" is made in small size, can be mounted on bench or stand. Spindle can be set vertical, horizontal, or at any angle between. It is a first-class tool for first-class work.

Waltham Watch Tool Co.

Springfield, Mass.

126 Liberty Street, New York.

Walter H. Foster, Manager.



..IMPROVED..

15-inch Hendey Shaper.

Latest Improvements.
Useful Attachments.
Strong and Powerful.

...FOR...

Die Work, Tool Room or General Shop Work.

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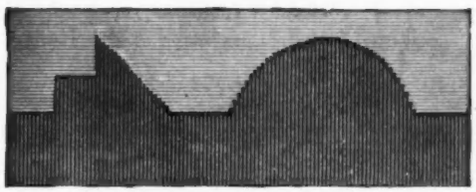
The stroke can be adjusted for curves with machine in motion. The stroke can be adjusted for angles with machine in motion. The stroke can be adjusted for irregular work with machine in motion. It has adjustable table for planing taper work; table can be removed for fastening work to apron. Has a strong graduated swivel vise. Quick work, rapid changes, modern ideas.



This cut shows how stroke can be adjusted with machine in motion by micrometer; adjustment fine and delicate. SEND FOR CIRCULAR.

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THE HENDEY MACHINE CO.

TORRINGTON, CONN.

Agents for the Pacific Coast—PACIFIC TOOL AND SUPPLY COMPANY, San Francisco, Cal.

European Agents, { CHAS. CHURCHILL & CO., London and Birmingham. SCHUCHARDT & SCHÜTTE, Berlin and Vienna. EUGEN SOLLER, Basel, Switzerland.

(Continued from page 34.)

number of large wood planers and other machinery to the value of $24,000. An $18,000 contract for planers, band saws, etc., to be used in a repair shop in Rio Janeiro, has been taken by a local house.

One of the wood-working machinery concerns represented in this city, The H. B. Smith Machine Company, has opened an export branch which is not confined to its own line of manufactures, but includes anything for which there may be a demand—iron telegraph poles, etc. They have in the past been in receipt of inquiries for such goods and seem to have thought that it was too bad to lose the benefit of them and also that it was a good idea to have two strings to their bow. This is an indication of the general tendency to cultivate the foreign market, and was undoubtedly a wise move.

Some difficult problems are, however, suggested by the incident, as to the relative advantages of a specialization or generalization of business. The latter policy is making headway in domestic trade, as embodied in the department store, and perhaps there is a stronger reason for it in export trade, from the lack of knowledge abroad as to who are the reliable manufacturers of any particular article. We see the idea extensively carried out in the present system of commission houses, and indeed it appears that dull times have a tendency to foster it.

PITTSBURG REPORT FOR JULY.

No doubt the past week in trade circles has been one of improved conditions. The passage of the Tariff bill has seemed to put a large amount of confidence into manufacturers of all kinds, and they are now of the belief that a good fall season will be experienced. There is now an air of certainty surrounding prospective buyers. As is well known, only a few months or even a month ago, those who contemplated purchasing machinery or material of any kind asked for bids in a half-hearted fashion, not caring whether they bought or not. This feeling existed among nearly all, and those figuring on the work were extremely cautious. But during the past week or so, the tide has turned, and when one asks for estimates he creates an understanding that he absolutely wants to buy, but at the lowest possible figure. This is the worse feature of the trade. Prices are yet extremely low, and it will be a hard matter to raise them. It will take weeks and weeks to do this.

A visit was made to several of the large plants in this and adjoining territory, and reports received were of a very encouraging nature. The U. Baird Machinery Company has secured plenty of orders lately and cherish a hopeful view of the future. The Ridgway Engine & Dynamo Works, at Ridgway, Pa., have their plant running regularly, with orders on hand to keep a large force of men employed.

New machinery has just been ordered for this establishment, which, when installed, will greatly increase the capacity. The Du Bois Iron Works, Du Bois, Pa., is rapidly completing its new brick buildings, to contain foundry and machine shops. A portion of the machine-shop equipment is now at hand, and it is confidently expected to have the plant in operation by October 1st.

The boiler trade has not been very active, although a large contract was received last week by the Cahall sales department for 6,500 horse-power of Cahall boilers, to be placed in the Edgar Thomson Steel Works, of the Carnegie Steel Company. The Cahall company have upwards of 30,000 horse-power of boilers under construction at their plant in Mansfield.

In rolling-mill machinery, the Frank Kneeland Machine Company, Pittsburg, seem to have received the bulk of trade lately. Contracts have been received from the Dennison (O.) Rolling Mill Company, Messrs. Hamilton & Co., and others.

Quotations.

NEW YORK, Monday, August 2.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 50 @$12 00
No. 2 foundry, Northern	10 50 @ 11 25
No. 2 plain, Northern	10 00 @ 10 75
Gray forge, Northern	9 50 @ 10 00
No. 1 foundry, Southern	10 50 @ 10 75
No. 2 foundry, Southern	10 00 @ 10 75
No. 3 foundry, Southern	9 75 @ 10 00
No. 1 soft, Southern	10 75 @ 11 00
No. 2 soft, Southern	— @ 10 50
Foundry forge, or No. 4, South'n	9 50 @ 9 75

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.00 @ 1.05c.; refined, 1.10 @ 1.15c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.35 @ 1.45c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.50c.

Cold Rolled Steel Shafting—Base size, in small lots, from store, 2¼c.

Copper—Carload lots, Lake Superior ingot, 11⅛ @ 11¼c.; electrolytic, 11 @ 11⅛c.; casting copper, 10¾c.

Pig Lead—Carload lots, 3.85c., f. o. b.

Pig Tin—For 5 and 10-ton lots, 13.90c., f.o.b.

Spelter—Carload lots, New York delivery, 4.30c., f. o. b.

Antimony—Cookson's, 7½ @ 8c.; Hallett's, 7¼ @ 7⅛c.

Lard Oil—Prime city, commercial quality, in wholesale lots, 36 @ 37c.

▲ ▲ ▲

Manufactures.

Near Reigelsville, Pa., a new rope factory is to be erected.

At Elizabeth, Pa., a new glass factory is to be erected.

At Salamanca, N. Y., a new glue factory is to be erected.

The Last Chance Mill, Bingham, Utah, is to be enlarged.

At Peoria, Ill., a large elevator is to be erected at an early date.

At San Bernardino, Cal., J. V. Suman will erect an addition to his mill.

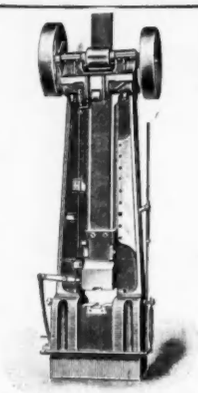
Verlenden Bros., Morton, Pa., are adding new machinery to their plant.

At Daleville, Ind., the Ideal Stove & Foundry Works are erecting a plant.

At Ashland, Ky., a rod mill is to be erected by the Ashland Steel Company.

The Empress Skirt Company, of Frankfort, Ind., will install new machinery.

(Continued on page 37.)



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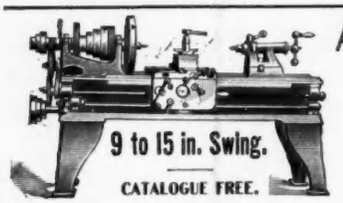

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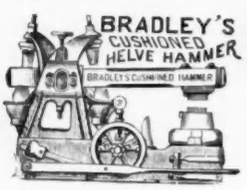

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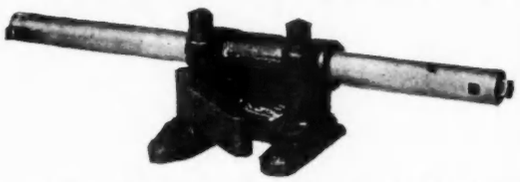

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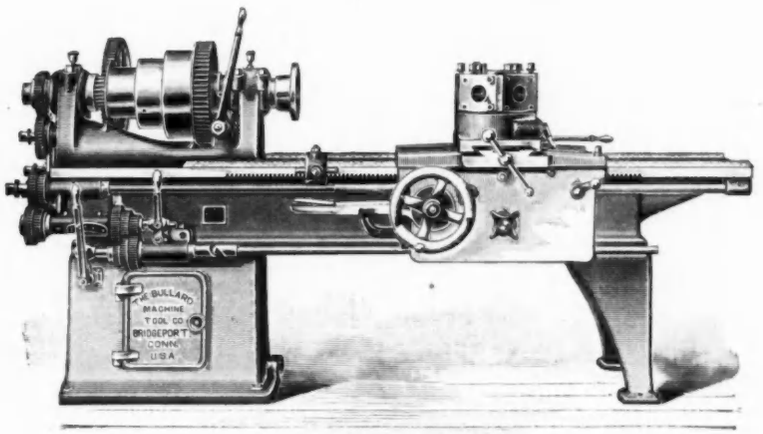

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(Continued from page 36.)

At Philadelphia, Pa., Charles McCaul is contemplating the erection of a mill.

At Menominee, Mich., Donovan & O'Connor's sawmill was destroyed by fire.

At Cambridge, Pa., the Edwards mill, which was recently burned, is to be rebuilt.

At Sellersville, Pa., John R. Newbold will erect a sash factory and planing mill.

At Bath, Me., the Torrey Roller Bushing Company are erecting a new foundry.

At Kettle Falls, Wash., the owners of the Republic mine are to erect a new mill.

The Bidwell Metal Tie Manufacturing Company, of El Dorado, has been organized.

The Steel Wheel Company, of Ramapo, N. Y., is contemplating removing its plant.

Mr. J. M. Stowell, of Milwaukee, Wis., will erect a machine shop on Barclay street, that city.

At Elwood, Ind., the Akron Forge Works contemplate the making of improvements.

Mr. T. Y. Conner, of Tuskegee, has decided to erect a cotton oil mill at Gadsden, Ala.

The North Wales Steam Mills, Philadelphia, Pa., are erecting an addition to their plant.

Dodson & Sutton, of Hamilton, O., are intending to make alterations to their plant.

John Bill & Bro., Jasper street, Philadelphia, Pa., will erect an addition to their factory.

At New Iberia, La., Mr. Geo. Simon, is intending to make an addition to his foundry.

At Fayetteville, Tenn., the planing mill of Lernis & Williams was recently destroyed by fire.

At Reed City, Mich., the plant of the Lowell Manufacturing Company has been destroyed by fire.

At West Bay City, Mich., the Whittemore Machine Company's plant was recently gutted by fire.

The Home Laundry, at Bedford, Ind., are contemplating the installation of new machinery.

McFarlane & Co., of Black Hawk, Col., have received the contract for the erection of a new stamp mill.

The Dupaul-Young Optical Works, at Southbridge, Mass., are having additions made to their plant.

The Poughkeepsie (N. Y.) Glass Works, recently burned, are to be reconstructed on a larger scale.

At Waterville, Me., the Skowhegan Electric Light & Power Company will erect a new power station.

The planing mill of the Mills Dry Dock Company, Buffalo, N. Y., has recently been destroyed by fire.

The foundry and machine shops belonging to John Bunn, Cayuga, Ont., have been destroyed by fire.

There is a possibility that the Calumet & Hecla Mining Company will erect a stamp mill at Linden, Mich.

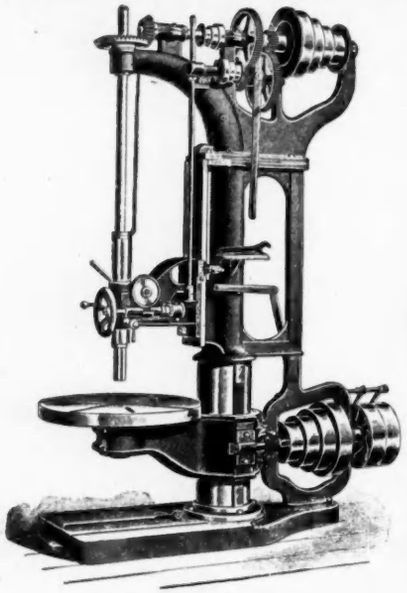
The plant of the Colebrookdale Iron Works, which is being erected at Philadelphia, is nearing completion.

A syndicate from Spring City has purchased a factory at Phoenixville, Pa., and will make many improvements.

The hub and spoke factory of J. D. Robinson & J. Riede, at Huntsville, O., has been completely destroyed by fire.

The Excelsior Foundry, at Bay City, Mich., was recently destroyed by fire, and damaged to the amount of $13,000.

At Augusta, Me., the Augusta Shoe Manufacturing Company has been organized with the following officers: President, S. C. Darling, Boston, Mass.; vice-president, W. H. Aldrich; treasurer, M. V. B. Chase.



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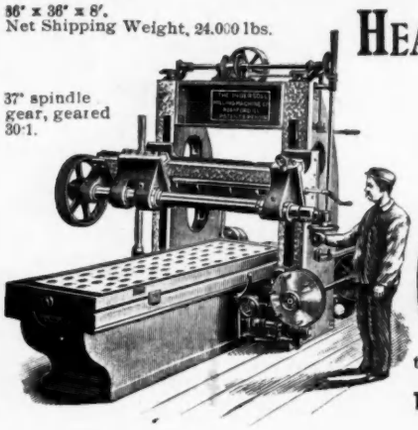

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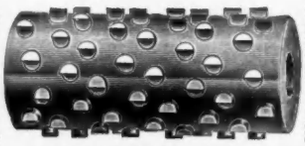

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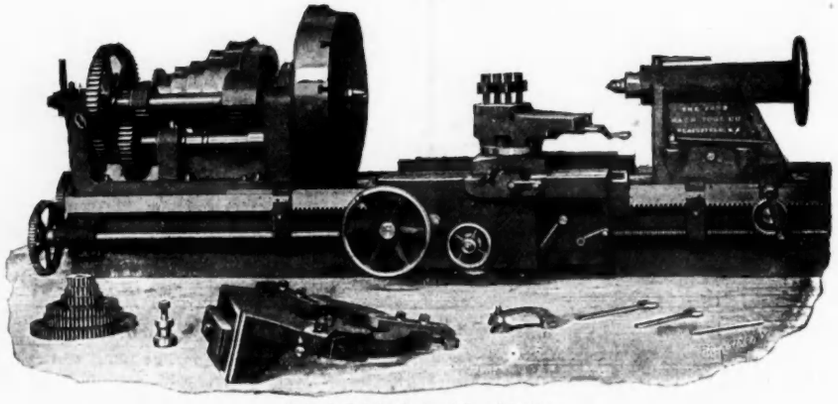

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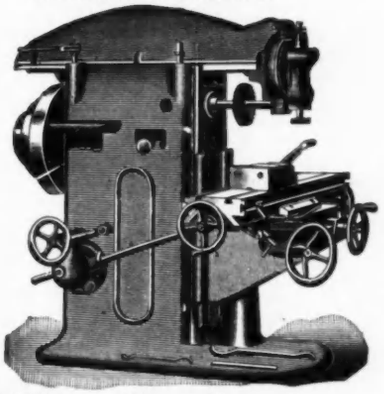

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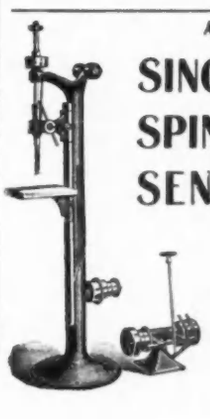

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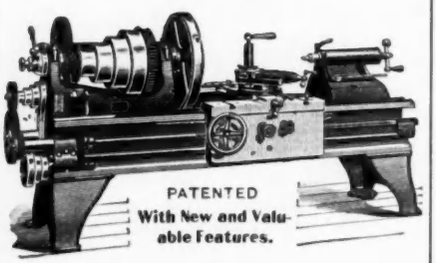

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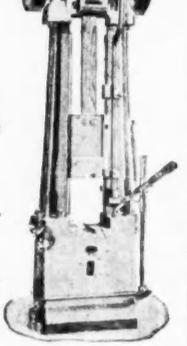

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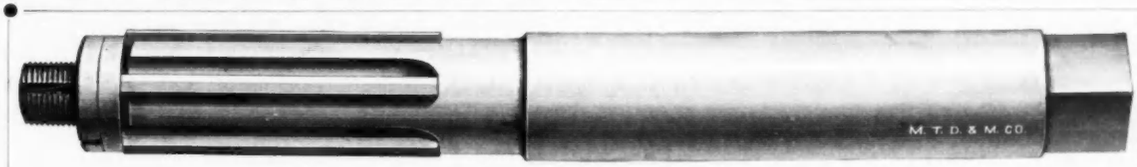

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AURORA, IND.

UPRIGHT AND RADIAL DRILLS.

Patent Automatic Stop.
12 in. to 40 in. Swing.
80 in. Radial.

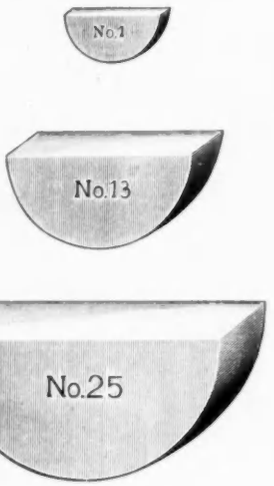
Pittsburg Tool Steel Co.,

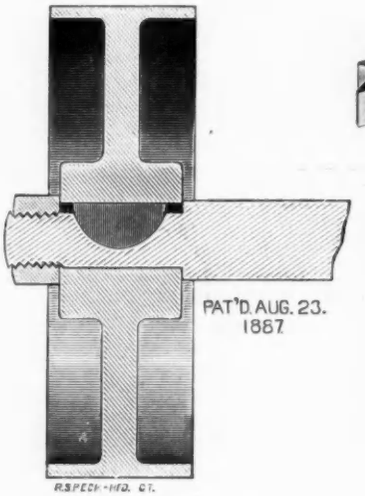
Ferguson Block, Pittsburg, Pa.

COMPARATIVE TEST AT PITTSBURG LABORATORY.

Brand of Steel.	Elastic Limit.	Tensile Strength.	Elongation.	Reduction.
0.69 Damascus Process	119.650	179.600	4.70	13.06

Presto Drill Chuck





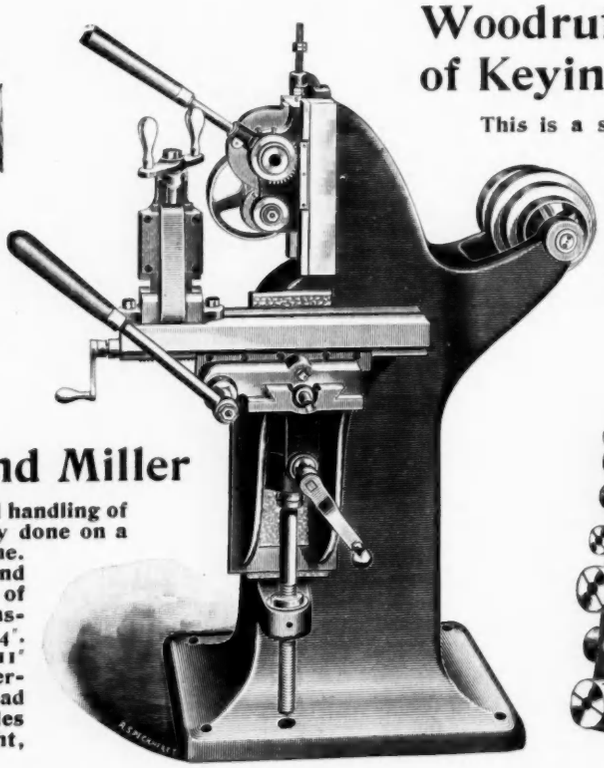
For the rapid change of Drills, Reamers, Counterborers, etc., without stopping the spindle of the drill press. A saving of time that goes to make this tool a necessity in every modern progressive shop.

"Presto Points" for the asking.

• • •

Woodruff Pat. System of Keying . . . .

This is a semi-circular key sunk into shaft far enough to leave sufficient projection of key above surface. The operation of cutting key-seat is very simple and requires no skilled labor. Quite a description of this system is ready for those interested.



Universal Hand Miller

For the rapid and economical handling of a wide range of work usually done on a light power milling machine. Movement of table by rack and hand lever, 5". Movement of table by screw, 9½". Transverse movement of table, 4". Top of table can be lowered 11" from the center of spindle. Vertical movement of spindle head by rack and lever, 3". Grades of cones, 9", 6½" and 5". Weight, complete, 757 lbs.

Other Good Tools are:

Speed Lathes Swing, 13". Length of bed, 5 ft. Distance between centers, 33". Weight, with countershaft, 550 lbs. Cone has four grades for 1⅞" belt. Hole in spindle ⅝". Total length of spindle, 16." Other details in "Speed Lathe Circular."

• • •

Bicycle Chain Block Drilling and Reaming Machine For the continuous operation of drilling and reaming the center blocks of bicycle chains. Capacity, 2000 blocks per 10 hrs. "The Story" tells the rest.

• • •

The Whitney Mfg. Co.,

Hartford, Conn., U. S. A.

Polishing Arbors

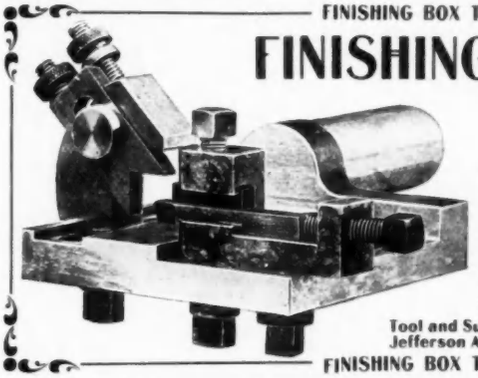
With Stand.

By the use of our system of polishing arbors, you will save your expensive turning arbors, which soon run out of true if used for polishing. They save time, labor and money.

"Arbor Talk" free.

FINISHING BOX TOOLS

FINISHING BOX TOOLS



FOR SCREWS, STUDS, ETC.

Bardons & Oliver,

CLEVELAND, O., U. S. A.

Ask for these Tools at these places:
Hill, Clarke & Co., 14 So. Canal St., Chicago. J. J. McCabe, 14 Dey St., N. Y. Hill, Clarke & Co., 156 Oliver St., Boston. Patterson Tool and Supply Co., Dayton, O. H. M. Crouse & Co., 19 Jefferson Ave., Detroit. Erie Supply Co., Erie, Pa.

FINISHING BOX TOOLS

The Hot Casting is the Finished Thing.

ALUMINUM FINISHED CASTINGS

We are now able to offer finished aluminum castings (pure metal) in difficult shapes. Positively no machine work. Illustrated circular on application.

H. H. FRANKLIN MFG. CO.
Franklin St., SYRACUSE, N. Y.

Send for Catalogue U, showing FITCHBURG PLANERS, LATHES, SHAPERS, DRILLS, ETC.

FOREIGN AGENTS.

GREAT BRITAIN,
Richard Lloyd & Co.
Birmingham.

DENMARK,
NORWAY,
SWEDEN,
V. Lowener,
Copenhagen.

GERMANY,
AUSTRIA,
FRANCE,
RUSSIA,
Markt & Co., Ltd.

AUSTRALIA,
Edge & Edge,
Sidney.

IT IS A "GEM"

14" SWING (7' CENTERS).

POWER CROSS FEED.

Pat. Friction with Automatic and Hand Stop, Operating in Either Direction.

▲ ▲ ▲

GOOD, HONEST LATHE.
LOW PRICE.

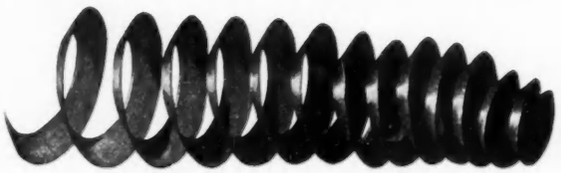
Chapman "Duplex Feed"

Gives Roughing (Gear) Feed and Finishing (Belt) Feed, which does quickest work.

Feeds indexed. THREADS cut 4 to 40 inc. Pipe thread. Feed belt tightener, makes it possible to use spliced belt.

FITCHBURG MACHINE WORKS, FITCHBURG, MASS., U. S. A.

WE ARE STEPS IN ADVANCE.



"'TIS A GOOD ONE."

Above Chip taken with the GEM LATHE.
Steel bar reduced from 2¼" to 1".
Feed, 31 per inch.
Revolutions per minute, 13½.

CAN YOU AFFORD TO BE WITHOUT THE "GEM"?

American and other Patents.

ATTENTION!

A Trial will Confirm it.

OUR WORLD
Pulley Blocks:

"MAXIM" Screw Blocks with Maxim Brake,
"Victoria" Cast-Steel TOOTH-WHEEL PULLEY BLOCKS with Duplex Brake,
exceed all other Pulley-Blocks astonishingly in every respect.

Prices considering quality, very cheap. Ask for Catalogue.

GEBR. BOLZANI, Berlin N. 4. (Germany)

Most important manufacturers of Patented Pulley-Blocks, Traveling Pulley Blocks and Crabs.

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WORCESTER MACHINE SCREW CO.

Manufacturers of Set, Cap & Machine Screws, Studs, etc.

Drop Hammers,
Presses,
Special Mach'y Dies,
THE STILES & FLADD PRESS CO.,
WATERTOWN, N. Y.

AUTOMATIC FRICTION CLUTCH CO.

CATALOG ON REQUEST.
821 STATE STREET,
ERIE, PA.

TURRET
Boring and Turning Machine.

A Machine that no Shop can Afford

To be Without!

WRITE FOR FULL DESCRIPTION.

Beats the **Lathe** many times over for **Boring Small Work.**

CORRESPONDENCE SOLICITED.

The Niles Tool Works Company,

Main Office and Works, HAMILTON, OHIO.

English Branch, 39 Victoria St., London, S. W.

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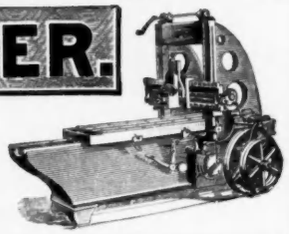
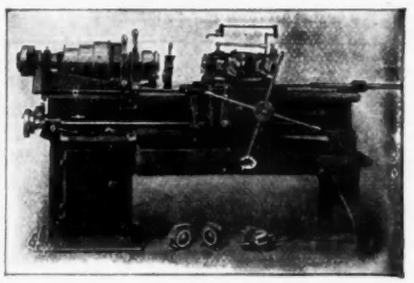
THE GRAY PLANER.



THE G. A. GRAY CO., CINCINNATI, O.

These Machines are sold by the following Agents:

HILL, CLARKE & CO., 14 South Canal St., Chicago, Ill.
STRONG, CARLISLE & TURNEY CO., 193 Bank St., Cleveland, O.
E. A. KINSEY & CO., 331 West Fourth St., Cincinnati, O.
THOS. K. CAREY & BROS. CO., 26 Light St., Baltimore, Md.
J. J. McCABE, 14 Dey St., New York City.
PACIFIC TOOL & SUPPLY CO., 102 First St., San Francisco, Cal.
SCHUCHARDT & SCHUTTE, Berlin, Vienna and Brussels.
CHAS. CHURCHILL & CO., Ltd., London and Birmingham, England.



The Flat Turret Lathe

Does Lathe work accurately up to 2 in. diameter by 24 in. long.

◆

Jones & Lamson Machine Co.

Springfield, Vt., U. S. A.

Representative for Germany, Switzerland, Austria-Hungary, Russia, Holland and Belgium: M. KOYEMANN, Charlottenstrasse, 113, Dusseldorf, Germany.

England: HENRY KELLEY & CO., 26 Pall Mall, Manchester.

Do You Know?

That you can take the **HEAVIEST CUTS AT THE HIGHEST RATE OF SPEED** by having your tools accurately ground by our

Universal Tool Grinders?

The No. 1 machine will grind and shape tools with shanks up to 2½ inches by 2 inches. The No. 2 will take tools up to 2 inches by 1½ inches. As savers of time and money these machines are unrivaled.

William Sellers & Co. Incorp. PHILADELPHIA.

POWERFUL GRIP. PERFECTLY TRUE.

Weir Drill Chucks

Positively DUST Proof. We GUARANTEE Them.

These Chucks are in use on Turret, Milling and Drill Machines, also Bit Braces and Breast Drills.

We carry in stock a full line of Lathe, Planer and Key Drill Chucks, Drill Grinders, Drilling Machines, Drill Press Ballbearing Centering Tools, Thumb Screw Handy Vises, Lathe and Planer Tool Holders.

Specify your needs in sending for Catalogues.

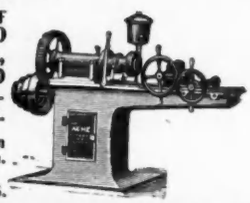
The Pratt & Weir Chuck Co.

HARTFORD, CONN., U. S. A.

THE **ACME** Machinery Co.

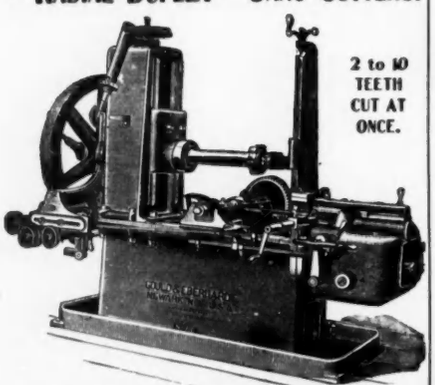
CLEVELAND, O.

MANUFACTURERS OF ACME BOLT AND RIVET HEADERS, ACME SINGLE AND DOUBLE AUTOMATIC BOLT CUTTERS, cutting from ⅝ in. to 6 in. diam. SO SEPARATE HEADS AND DIES.



PATENT ENTIRELY AUTOMATIC

GEAR CUTTERS & "RADIAL DUPLEX" GANG CUTTERS.



2 to 10 TEETH CUT AT ONCE.

GOULD & EBERHARDT.

NEWARK, NEW JERSEY, U.S.A.

Foreign Agents: JOHN LANG & SONS, Johnstone, Scotland. SCHUCHARDT & SCHUTTE, Berlin, Vienna, Brussels. G. KORFFEN & Co., Moscow, Russia. Shaper Agents. WHITE, CHILD & BENBY, Vienna, Aus. Shaper Agents.

SHULTZ PATENT SABLE RAWHIDE BELTING.
SHULTZ BELTING Co.
SHULTZ PATENT WOVEN LEATHER LINK BELTING
GENUINE RAWHIDE LACE LEATHER. SHULTZ'S PATENT PULLEY COVER. BELT DRESSING AND BELT CEMENT.
DYNAMO BELTING.
Send for Circulars.

EXPORT TRADE A SPECIALTY. ST. LOUIS, MO.

SET AND CAP SCREWS

STUDS — CINCINNATI SCREW & TAP Co. — NUTS

STANDARD AND SPECIALS.

CINCINNATI, O., U. S. A.

FOR ENGINES AND MACHINERY.

JUST ISSUED — CATALOGUE NO. 9,

CLAYTON AIR COMPRESSORS.

And mailed free on application. Special Air Compressors for all R.R. Car Shop uses.

CLAYTON AIR COMPRESSOR WORKS, 26 CORTLANDT ST., NEW YORK.

CRANES

PAWLING & HARNISCHFEGER,

163 Clinton Street, MILWAUKEE, WIS.

GRANT GEARS

GEAR WHEELS CUTTING

Grant Gear Works,

125 South 11th Street, PHILADELPHIA.
6 Portland Street, BOSTON.
86 Seneca Street, CLEVELAND.

Send for Catalog.

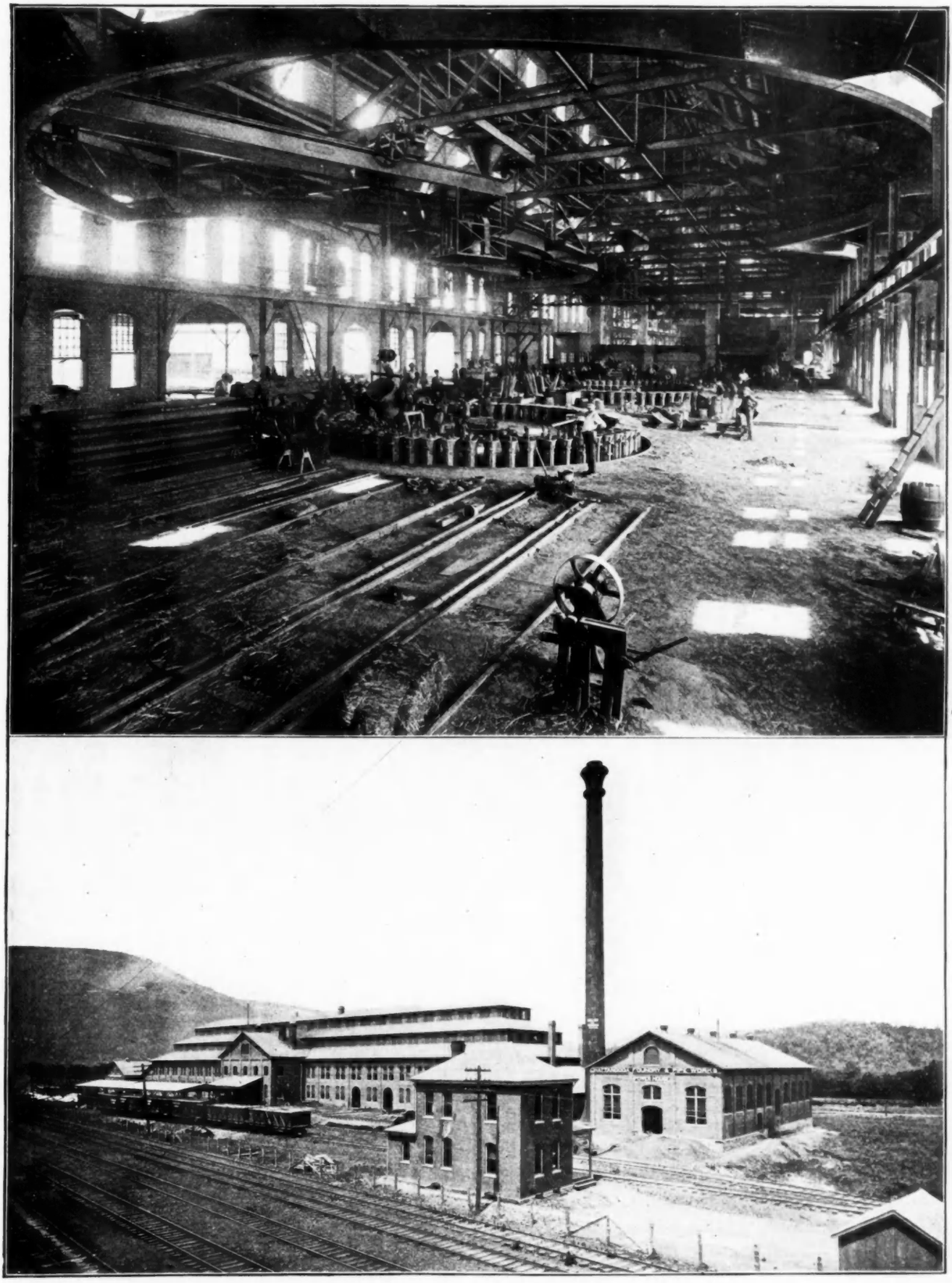
MANUFACTURERS OF

Twist Drills, Reamers and Taps

THE STANDARD TOOL CO.

CLEVELAND, OHIO.

Spring Cotters and Flat Spring Keys.



THE CHATTANOOGA PIPE FOUNDRY.

New machinery has just been ordered for this establishment, which, when installed, will greatly increase the capacity. The Du Bois Iron Works, Du Bois, Pa., is rapidly completing its new brick buildings, to contain foundry and machine shops. A portion of the machine-shop equipment is now at hand, and it is confidently expected to have the plant in operation by October 1st.

The boiler trade has not been very active, although a large contract was received last week by the Cahall sales department for 6,500 horse-power of Cahall boilers, to be placed in the Edgar Thomson Steel Works, of the Carnegie Steel Company. The Cahall company have upwards of 30,000 horse-power of boilers under construction at their plant in Mansfield.

In rolling-mill machinery, the Frank Kneeland Machine Company, Pittsburg, seem to have received the bulk of trade lately. Contracts have been received from the Dennison (O.) Rolling Mill Company, Messrs. Hamilton & Co., and others

Quotations.

NEW YORK, Monday, August 2.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 50 @ $12 00
No. 2 foundry, Northern	10 50 @ 11 25
No. 2 plain, Northern	10 00 @ 10 75
Gray forge, Northern	9 50 @ 10 00
No. 1 foundry, Southern	10 50 @ 10 75
No. 2 foundry, Southern	10 00 @ 10 75
No. 3 foundry, Southern	9 75 @ 10 00
No. 1 soft, Southern	10 75 @ 11 00
No. 2 soft, Southern	— @ 10 50
Foundry forge, or No. 4, South'n	9 50 @ 9 75

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.00 @ 1.05c.; refined, 1.10 @ 1.15c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.35 @ 1.45c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.50c.

Cold Rolled Steel Shafting—Base size, in small lots, from store, 2½c.

Copper—Carload lots, Lake Superior ingot, 11¾ @ 11¼c.; electrolytic, 11 @ 11⅛c.; casting copper, 10¾c.

Pig Lead—Carload lots, 3.85c., f. o. b.

Pig Tin—For 5 and 10-ton lots, 13.90c., f.o.b.

Spelter—Carload lots, New York delivery, 4.30c., f. o. b.

Antimony—Cookson's, 7½ @ 8c.; Hallett's, 7¼ @ 7½c.

Lard Oil—Prime city, commercial quality, in wholesale lots, 36 @ 37c.

▲ ▲ ▲

Manufactures.

Near Reigelsville, Pa., a new rope factory is to be erected.

At Elizabeth, Pa., a new glass factory is to be erected.

At Salamanca, N. Y., a new glue factory is to be erected.

The Last Chance Mill, Bingham, Utah, is to be enlarged.

At Peoria, Ill., a large elevator is to be erected at an early date.

At San Bernardino, Cal., J. Y. Suman will erect an addition to his mill.

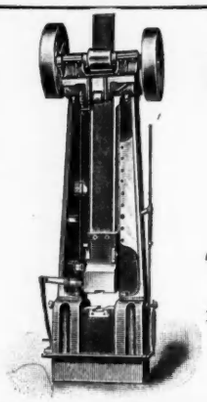
Verlenden Bros., Morton, Pa., are adding new machinery to their plant.

At Daleville, Ind., the Ideal Stove & Foundry Works are erecting a plant.

At Ashland, Ky., a rod mill is to be erected by the Ashland Steel Company.

The Empress Skirt Company, of Frankfort, Ind., will install new machinery.

(Continued on page 37.)



Drop Hammers Recently Improved.

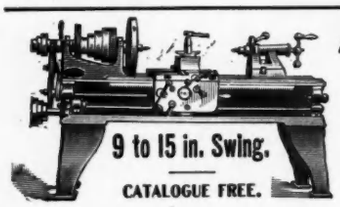
Have the metal of the most enduring qualities intelligently distributed throughout. PAPER PULLEYS that give no trouble. Hammers and Die Blocks of steel. JOINTS and BOLTS CUSHIONED with rawhide or leather. BEDS of each size, 250 to 2,400 pound hammers, made 10 and 15 times the weight of the hammer.

DIE SINKERS, four sizes; TRIMMING PRESSES, two sizes.

THE PRATT & WHITNEY COMPANY,
HARTFORD, CONN., U. S. A.

New York: 123 Liberty St. Boston: 281 Franklin St. Chicago: 42 South Clinton St. Buck & Hickman, 280 Whitechapel Road, London, Eng. Fenwick Freres & Co., 21 Rue Martel, Paris, France.

Ask for the Machinists' Catalogue.



ARE YOU LOOKING for a lathe? We are building them in various sizes from 9 in. to 15 in. swing, in various lengths, both engine and speed lathes. Our designs are the **latest**, while the **workmanship, material** and **finish** are of the **highest** order. Our catalogue will tell you all about them, as well as of our planers, shapers and other tools.

SEBASTIAN LATHE COMPANY,
117 & 119 Culvert St., Cincinnati, Ohio, U. S. A.

NOW READY.

ELECTRIC RAILWAYS AND TRAMWAYS
THEIR CONSTRUCTION AND OPERATION.
A PRACTICAL HANDBOOK by PHILIP DAWSON, C. E. 530 Figures, 183 Tables, 705 Pages, Demi-quarto, Half Morocco. $12.50.
JOHN WILEY & SONS, Scientific Publishers, 53 East Tenth Street, New York City

"GREEN RIVER" PATENT SPIRAL FLUTED SHELL REAMERS AND ARBORS IN CASES.
SEND FOR CATALOGUE.

WILEY & RUSSELL MFG. CO., Greenfield, Mass., U. S. A
Agents in London, SELIG, SONNENTHAL & CO., 85 Queen Victoria Street.

DYER & DRISCOLL,
PATENT SOLICITORS, 31 NASSAU STREET, N. Y.

I have done all my patent soliciting work, both for this and foreign countries, continuously for the past fourteen years.
Thomas A. Edison

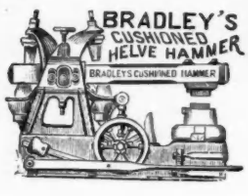
STAR LATHES
★ ★ ★
Foot Power Screw Cutting, Automatic Cross Feed, 9 and 11" Swing.
Send for Catalog B.
Seneca Falls Mfg. Co.
687 Water St., Seneca Falls, N.Y.

WHEN YOU ARE OFFERED JENKINS' or JENKINS BROS.' DISCS that have Trade Mark same as cut, they are all right for high pressure steam. All others are imitations and you cannot hold us responsible. If you cannot get our discs from your dealer, send to us for them.

JENKINS BROS., 71 John Street, New York.
31 N. Canal St., Chicago. 117 N. 4th St., Philadelphia. 17 Pearl St., Boston.

Die and Tool Steel.
NO BETTER MADE.

CRESCENT STEEL CO.
PITTSBURGH, PA.
CHICAGO, ILL.
NEW YORK, N. Y.
DENVER, COL.



BRADLEY HAMMERS
THE BEST POWER HAMMERS ON EARTH.
22 sizes in Helve, Upright and Strap Styles.
Send for Printed Matter.
The Bradley Company
Syracuse, N. Y.

"HONEST JOHN"

For Water and Hydraulics.

NOTHING IN THE WORLD LIKE IT.

PATENTED AND MANUFACTURED EXCLUSIVELY BY

Peerless Rubber Manufacturing Company,

16 Warren Street, New York.

16-24 Woodward Ave., Detroit, Mich. 202-210 South Water St., Chicago, Ill.

HYDRAULIC RAINBOW CORE PACKING.

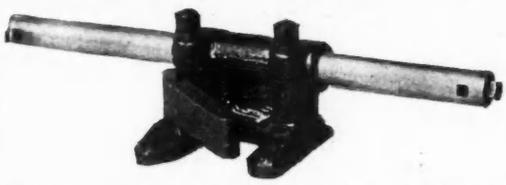
REG. TRADE MARKS

"Phosphor Bronze"

DELTA

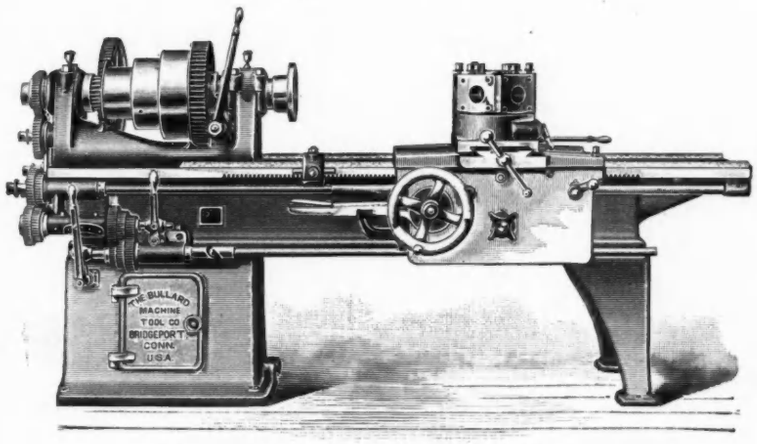
THE PHOSPHOR BRONZE SMELTING CO. LIMITED,
2200 WASHINGTON AVE., PHILADELPHIA.
"ELEPHANT BRAND PHOSPHOR-BRONZE"
INGOTS, CASTINGS, WIRE, RODS, SHEETS, ETC.
— DELTA METAL —
CASTINGS, STAMPINGS AND FORGINGS
ORIGINAL AND SOLE MAKERS IN THE U.S.

THE MOST RIGID BORING TOOL ON THE MARKET.



Bar is one continuous piece. The most rigid boring tool on the market. Works equally as well on inside or outside. Excellent tool for turning full swing of lathe. Size of bar ¾ in. to 3 in.; size of cutter. ¼ in. to ¾ in. Length of bar from 12 inches to 30 inches. The support of bar need be no farther from point than depth of hole to be bored. Write for Catalogue.

THE HUGH HILL TOOL CO., Anderson, Ind.



This is our 22-inch "Combination" Lathe. It will handle good-sized work and produce duplicate parts that must be turned, bored, faced or threaded, cheaper and better than can be done on lathes. Its range of feeds and speeds allow it to do a great variety of work and lots of it. We will be glad to furnish full information about this and other modern manufacturing tools. Bullard Machine Tool Co., Bridgeport, Conn.

(Continued from page 36.)

At Philadelphia, Pa., Charles McCaul is contemplating the erection of a mill.

At Menominee, Mich., Donovan & O'Connor's sawmill was destroyed by fire.

At Cambridge, Pa., the Edwards mill, which was recently burned, is to be rebuilt.

At Sellersville, Pa., John R. Newbold will erect a sash factory and planing mill.

At Bath, Me., the Torrey Roller Bushing Company are erecting a new foundry.

At Kettle Falls, Wash., the owners of the Republic mine are to erect a new mill.

The Bidwell Metal Tie Manufacturing Company, of El Dorado, has been organized.

The Steel Wheel Company, of Ramapo, N. Y., is contemplating removing its plant.

Mr. J. M. Stowell, of Milwaukee, Wis., will erect a machine shop on Barclay street, that city.

At Elwood, Ind., the Akron Forge Works contemplate the making of improvements.

Mr. T. Y. Conner, of Tuskegee, has decided to erect a cotton oil mill at Gadsden, Ala.

The North Wales Steam Mills, Philadelphia, Pa., are erecting an addition to their plant.

Dodson & Sutton, of Hamilton, O., are intending to make alterations to their plant.

John Bill & Bro., Jasper street, Philadelphia, Pa., will erect an addition to their factory.

At New Iberia, La., Mr. Geo. Simon, is intending to make an addition to his foundry.

At Fayetteville, Tenn., the planing mill of Lernis & Williams was recently destroyed by fire.

At Reed City, Mich., the plant of the Lowell Manufacturing Company has been destroyed by fire.

At West Bay City, Mich., the Whittemore Machine Company's plant was recently gutted by fire.

The Home Laundry, at Bedford, Ind., are contemplating the installation of new machinery.

McFarlane & Co., of Black Hawk, Col., have received the contract for the erection of a new stamp mill.

The Dupaul-Young Optical Works, at Southbridge, Mass., are having additions made to their plant.

The Poughkeepsie (N. Y.) Glass Works, recently burned, are to be reconstructed on a larger scale.

At Waterville, Me., the Skowhegan Electric Light & Power Company will erect a new power station.

The planing mill of the Mills Dry Dock Company, Buffalo, N. Y., has recently been destroyed by fire.

The foundry and machine shops belonging to John Bunn, Cayuga, Ont., have been destroyed by fire.

There is a possibility that the Calumet & Hecla Mining Company will erect a stamp mill at Linden, Mich.

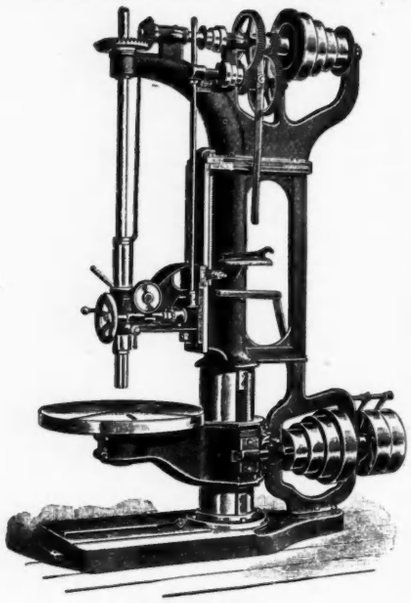
The plant of the Colebrookdale Iron Works, which is being erected at Philadelphia, is nearing completion.

A syndicate from Spring City has purchased a factory at Phoenixville, Pa., and will make many improvements.

The hub and spoke factory of J. D. Robinson & J. Riede, at Huntsville, O., has been completely destroyed by fire.

The Excelsior Foundry, at Bay City, Mich., was recently destroyed by fire, and damaged to the amount of $13,000.

At Augusta, Me., the Augusta Shoe Manufacturing Company has been organized with the following officers: President, S. C. Darling, Boston, Mass.; vice-president, W. H. Aldrich; treasurer, M. V. B. Chase.



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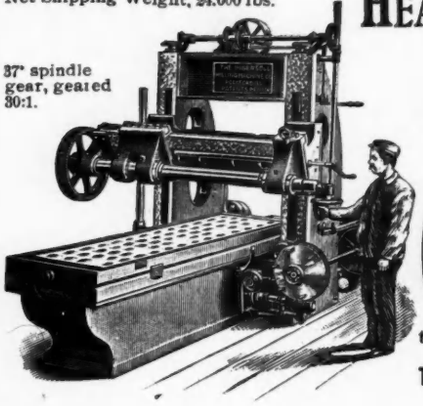

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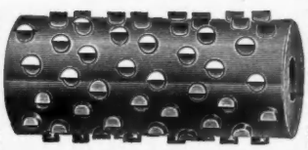

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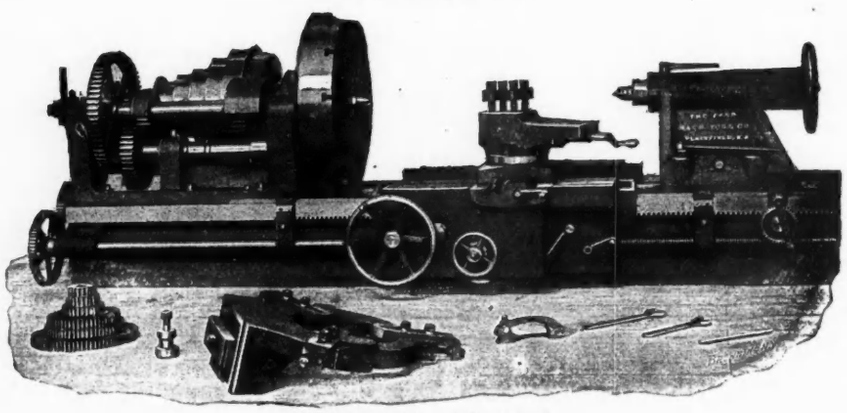

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